

FINAL SUBMITTAL

EXECUTIVE SUMMARY

ENERGY SURVEYS OF  
ARMY BOILER PLANTS

ENERGY ENGINEERING  
ANALYSIS PROGRAM (EEAP)

AT

FORT LEWIS, WASHINGTON

Prepared for

DEPARTMENT OF THE ARMY  
SEATTLE DISTRICT, CORPS OF ENGINEERS

under

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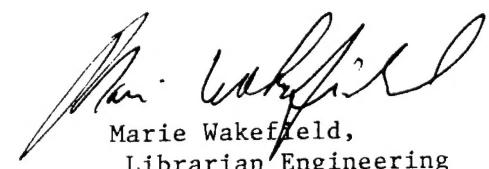


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This report has been prepared at the request of Seattle District, Corps of Engineers, and the observations, conclusions, and recommendations contained herein constitute the opinions of E M C Engineers, Inc.

Actual energy cost savings of recommendations are dependent on many unpredictable factors. Weather, operating procedures, adequate comfort levels, additions of or changes to conditioned space, and changes in utility rates can effect total energy cost and savings. Energy cost savings identified in this study are not guaranteed and are estimates only of savings which may be realized.

SECTION E  
EXECUTIVE SUMMARY

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## SECTION E

### EXECUTIVE SUMMARY

#### **E.1 INTRODUCTION**

This report includes results of investigation of 304 boilers at Ft. Lewis. This EEAP study is being performed under Contract No. DACA67-87-C-0027 issued by the Seattle District U.S. Army Corps of Engineers to E M C Engineers, Inc. of Eugene, Oregon.

The purpose of this study is to perform evaluations and recommend energy conservation opportunities to selected boilers at the Ft. Lewis Army Base in Tacoma, Washington. A representative sample of the selected boilers are to be tested and the seasonal efficiency of each determined and extrapolated to the remaining boilers.

#### **E.2 ENERGY USE DATA**

Energy use data for the boilers included in this study was provided by the Directorate of Engineering and Housing (DEH). Ft. Lewis currently purchases natural gas from Washington Natural Gas Company in Tacoma, Washington, and is supplied fuel oil, both No. 2 and No. 6, through government purchase contracts. Current fuel rate schedules and contract rate schedules were obtained at the base during field data gathering.

##### **E.2.1 Actual Energy Cost Data**

Current fuel costs for electricity, natural gas, and fuel oil are summarized below: Data is current for October 1988.

- o No. 2 oil: \$0.65/gallon
- o No. 6 oil: \$0.55/gallon
- o Natural gas from \$0.236 to \$0.568 per therm depending on rate schedule and monthly use level.
- o Electricity: \$0.022 per kWh including demand

Regional energy rates dictated by ECIP guidance and current local rates are as follows:

<u>Fuel Type</u>	<u>ECIP Rates \$Million Btu</u>	<u>Local Rates \$/Million Btu</u>
Electricity	7.44	6.45
Natural Gas (firm)	5.89	4.75
Distillate Oil	6.62	4.68
Residual Oil	6.25	3.66

### E.3 PRESENT ENERGY CONSUMPTION

The average and extreme conditions of historic annual fuel use for the boilers studied under this contract are listed below. In addition to total fuel use, fuel use per square foot is also listed. Data is for plants where served building square footage was supplied. Detailed use for each boiler is included in Section 2 of the project report.

	<u>Million Btus/Yr. Per Boiler</u>	<u>Energy Use Index Btu/Sq.Ft/Yr.</u>
Average Energy Use:	988	80,634
Highest Energy Use:	9,462	598,876
Lowest Non-Zero Energy Use:	29	746
Standard Deviation:	1,335	55,848

Total Energy Use for all Boilers: 771,957 million Btu's/year

### E.4 BOILER DATA

Boiler condition, configuration, and type are described in detail in Section 3 of the Report. A general description of boiler condition for various boiler types follows:

- o Small packaged firetube hot water boilers in the barracks and small buildings are typically about 40 years old. Most are high in efficiency because water temperature has been lowered substantially and is controlled on an outside air reset. This procedure leads to high condensation rates in the boiler, which is accelerating deterioration. In generally very poor condition, these boilers are candidates for replacement.
- o Cast iron sectional steam boilers were originally coal fired. These boilers have small heat transfer areas and high stack temperatures. They are generally in poor condition and are inefficient.
- o Packaged relatively new firetube boilers are located in larger buildings. These typically have high stack temperatures and many are inefficient, even though they are relatively new.
- o Scotch marine boilers are in generally good condition and are high in combustion efficiency; however, many of them are oversized for their applications resulting in excessive jacket losses.
- o There are many other miscellaneous boiler types ranging from old locomotive type single pass boilers to large main plant boilers. The large main plant boilers receive the best maintenance of any of the boilers on the site. Consequently, they are operating at as high an efficiency as possible without retrofit modifications.

Boiler combustion efficiency ranges from 58.4% in the smaller boilers to 87.2% in the larger boilers.

## E.5 ENERGY CONSERVATION ANALYSIS

The approach to completing the EEAP analysis of Ft. Lewis is described below. The approach was applied to all applicable ECO's.

- o Algorithms were developed for each ECO using standard engineering analysis techniques.
- o The algorithms are incorporated into a computer model using the data generated in the boiler efficiency analysis as discussed in Section 4.
- o The results were reviewed by project engineers who had participated in the field survey and were familiar with the site conditions. Inappropriate boilers were eliminated and adjustments were made for specific site conditions.

### **E.5.1 ECO Investigated**

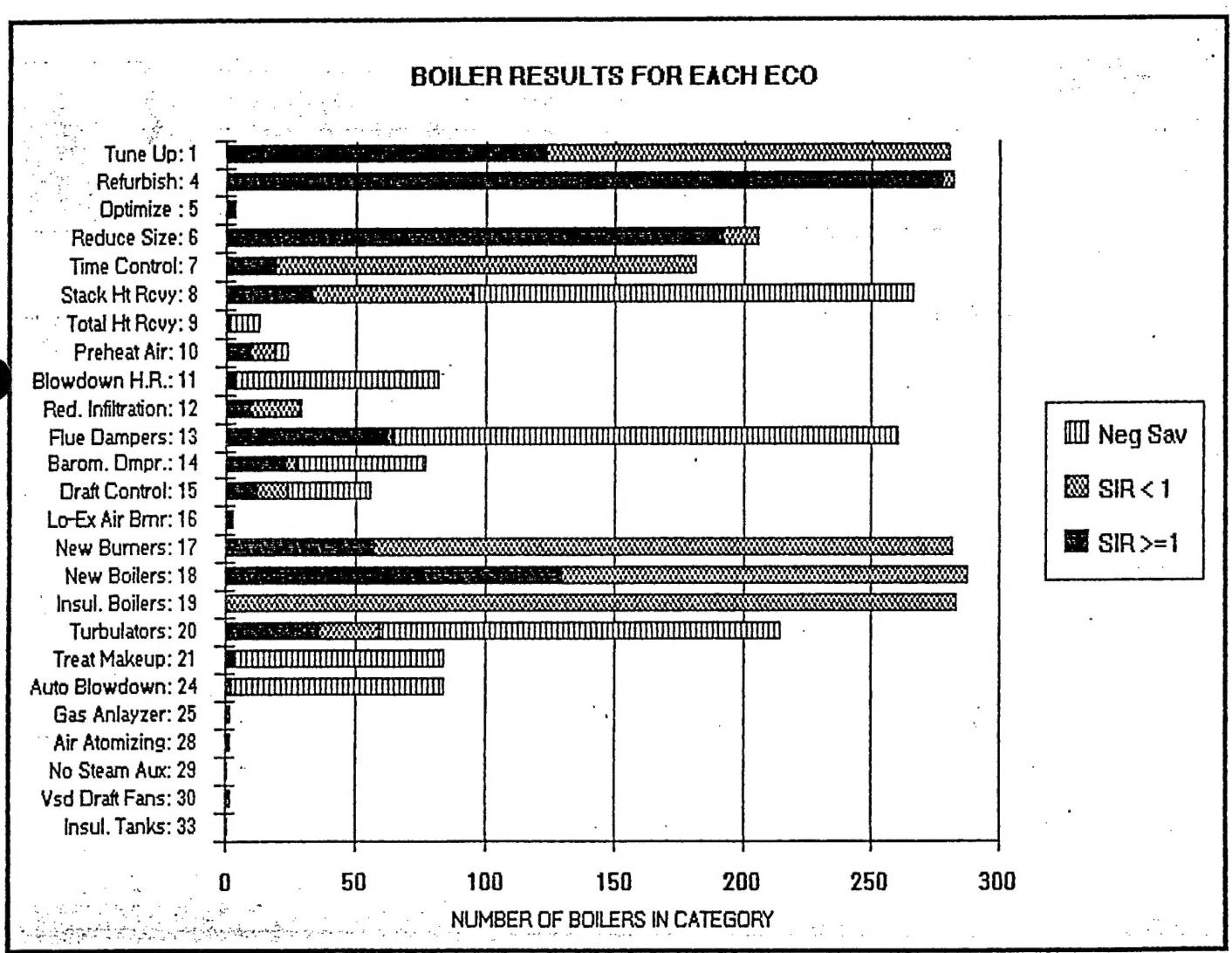
ECO's to be investigated were provided by the government and are included in Annex A of the statement of work which is in Appendix A of the project report. Based on the field survey and additional input from the Corps and DEH, the list was finalized as follows:

- ECO 1: Operator Tune-up
- ECO 2: Clean Water Side Transfer Surfaces
- ECO 3: Reduce Boiler Steam Pressure/Temperature
- ECO 4: Boiler Tune-Up and Refurbishment
- ECO 5: Optimizing Boiler Operating Schedule
- ECO 6: Match Boiler Capacity to Load
- ECO 7: Boiler Shutdown
- ECO 8: Stack Gas Sensible Heat Recovery
- ECO 9: Stack Gas Total Heat Recovery
- ECO 10: Preheat Combustion Air
- ECO 11: Boiler Blowdown Heat Recovery
- ECO 12: Reduce Infiltration
- ECO 13: Flue Gas Dampers
- ECO 14: Install Barometric Dampers
- ECO 15: Draft Control Modifications
- ECO 16: Low Excess Air Burners
- ECO 17: Replace Burners
- ECO 18: Replace Boiler
- ECO 19: Insulate Boiler
- ECO 20: Install Fire-Tube Turbulators
- ECO 21: Boiler Make-Up Water Treatment
- ECO 22: Boiler Feedwater Treatment
- ECO 23: Reduce Boiler Make-Up Water
- ECO 24: Automatic Boiler Blowdown
- ECO 25: Flue Gas Analyzer With Feedback Trim
- ECO 26: Outside Air Reset Control
- ECO 27: Install Desuperheaters or Back Pressure Turbines
- ECO 28: Switch from Steam to Air Atomization
- ECO 29: Steam Driven Auxiliaries Versus Electric Drives
- ECO 30: Variable Speed Mechanical Draft Fan
- ECO 31: Electric Motor Replacement
- ECO 32: Fuel Switching
- ECO 33: Insulate No. 6 Fuel Oil Storage Tanks
- ECO 34: Fuel Viscosity Control

### E.5.2 Analysis Results

The results in the ECO matrix are summarized in Figure E-1 below. For each ECO, the figure shows the quantity of boilers with a savings-to-investment ratio (SIR) greater than or equal to 1.0, an SIR less than 1.0, and the number of boilers which had a negative savings due to energy savings being less than the increases in maintenance cost. The remaining boilers were not appropriate for the ECO for reasons discussed in Section E.5.4. ECO's which had no applicable boilers are discussed in Section E.5.5 and are not shown in Figure E-1.

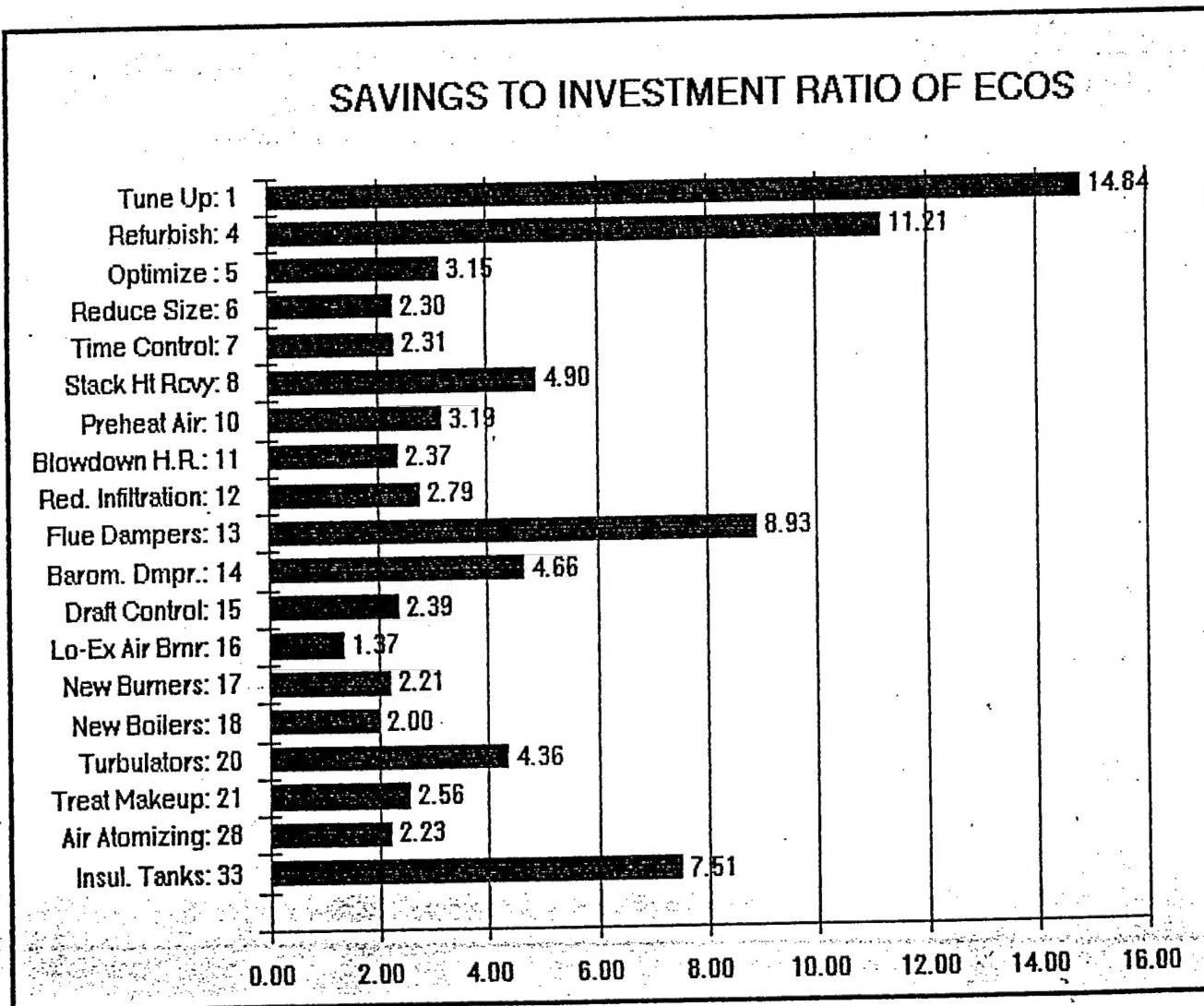
FIGURE E-1



### E.5.3 ECO Analysis Results Matrix

The results of the life cycle cost analysis included in Appendix E are shown on the ECO Matrix (Table E-1) on the following pages. The savings-to-investment ratio (SIR) is selected as the indicator of cost-effectiveness for the tables. Where the SIR is replaced with a \*1, this indicates that increased maintenance costs more than offset energy savings resulting in an increased annual operating cost. Where another numbered note appears, this indicates that the ECO did not meet the criteria listed in Section 5.4 of the Narrative Report for that particular boiler. Numbered notes are included following the Matrix on page E-23. Figure E-2 below illustrates the composite SIR for all boilers with a SIR greater than 1. ECO's without any SIR's greater than 1 are not included in Figure E-2.

FIGURE E-2



## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

TABLE E-1

Bldg-Blr Survey No.	No.	ECO 1 Blr	ECO 4 Blr	ECO 5 Opti-	ECO 6 Replic	ECO 7 Blr	ECO 8 Sensbl	ECO 9 Total	ECO 10 Pre-	ECO 11 Blwdn	ECO 12 Reduce	ECO 13 Flue	ECO 14 Baro-	ECO 15 Draft
		Tune up	Refur- bshmt	mize	with	Shut hours	heat Smaller	heat	heat	Heat	Infil-	Gas	metric	Cntrl

## HYDRONIC BOILERS:

7E1-1	1	0.6	1.6	*3	1.9	0.4	*1	*7	*8	*9	*11	*1	*12	*12
7E2-1	2	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E3-1	3	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E4-1	4	0.8	4.7	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E5-1	5	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E6-1	6	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E7-1	7	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E23-1	8	0.4	1.5	*3	1.9	0.4	*1	*7	*8	*9	*11	*1	*12	*12
7E24-1	9	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E25-1	10	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E26-1	11	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E27-1	12	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E28-1	13	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E29-1	14	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
7E30-1	15	0.4	1.5	*3	1.9	0.4	*1	*7	*8	*9	*11	*1	*12	*12
8E1-1	16	0.4	1.5	*3	1.9	0.4	*1	*7	*8	*9	*11	*1	*12	*12
8E2-1	17	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E3-1	18	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E4-1	19	0.8	4.7	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E5-1	20	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E6-1	21	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E7-1	22	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E8-1	23	0.4	1.1	*3	*4	0.3	*1	*7	*8	*9	*11	*1	*12	*12
8E23-1	24	0.4	1.5	*3	1.9	0.4	*1	*7	*8	*9	*11	*1	*12	*12
8E24-1	25	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E25-1	26	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E26-1	27	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E27-1	28	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E28-1	29	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E29-1	30	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
8E30-1	31	0.4	1.5	*3	1.9	0.4	*1	*7	*8	*9	*11	*1	*12	*12
9E1-1	32	0.6	4.4	*3	4.3	1.0	*1	*7	*8	*9	*11	*1	*12	*12
9E2-1	33	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
9E3-1	34	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12
9E4-1	35	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr No.	Survey No.		ECO 16	ECO 17	ECO 18	ECO 19	ECO 20	ECO 21	ECO 24	ECO 25	ECO 28	ECO 29	ECO 30	ECO 33
			Low	Replc	Replc	Insul	Fire	M. U.	Auto	O2	Air	Elim	Vari	Insul
		X-air	Burner	Burner	Boiler	Boiler	Tube	Water	Blow	Trim	Atomiz.	Stm	speed	Oil
					Turbs	Ht Rvry			down	Ctrl	ation	Aux	fans	Storag
7E1-1	1	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
7E2-1	2	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E3-1	3	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E4-1	4	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E5-1	5	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E6-1	6	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E7-1	7	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E23-1	8	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
7E24-1	9	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E25-1	10	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E26-1	11	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E27-1	12	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E28-1	13	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E29-1	14	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
7E30-1	15	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
8E1-1	16	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
8E2-1	17	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E3-1	18	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E4-1	19	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E5-1	20	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E6-1	21	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E7-1	22	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E8-1	23	*13	0.1	1.6	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
8E23-1	24	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
8E24-1	25	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E25-1	26	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E26-1	27	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E27-1	28	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E28-1	29	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E29-1	30	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
8E30-1	31	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
9E1-1	32	*13	0.3	0.9	0.4	*1	*9	*9	*17	*18	*19	*20	*21	
9E2-1	33	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
9E3-1	34	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
9E4-1	35	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

TABLE E-1

Bldg-Blr Survey No.	No.	ECO 1 Blr Tune up	ECO 4 Blr Refur- bshmt	ECO 5 Opti- mize	ECO 6 Replc hours	ECO 7 Blr Shut Down	ECO 8 Sensbl heat recvy	ECO 9 Total heat recvy	ECO 10 Pre- C-air	ECO 11 Blwdn Recvy	ECO 12 Reduce trat'n	ECO 13 Heat Infil-	ECO 14 Gas Dmptrs	ECO 15 Baro- Dmptrs	Draft Mod
9E5-1	36	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
9E6-1	37	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
9E7-1	38	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
9E8-1	39	0.4	1.5	*3	1.9	0.4	*1	*7	*8	*9	*11	*1	*12	*12	
9E23-1	40	0.4	1.5	*3	1.9	0.4	*1	*7	*8	*9	*11	*1	*12	*12	
9E24-1	41	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
9E25-1	42	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
9E26-1	43	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
9E27-1	44	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
9E28-1	45	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
9E29-1	46	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
9E30-1	47	0.4	1.3	*3	1.7	0.4	*1	*7	*8	*9	*11	*1	*12	*12	
2E1-1	49	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
3E6-1	50	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
3E12-1	51	0.8	6.0	*3	2.4	0.8	*1	*7	*8	*9	*11	*1	*12	*12	
3E15-1	52	0.7	2.5	*3	1.7	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
3E16-1	53	0.7	2.4	*3	1.7	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
3E38-1	54	1.2	4.3	*3	0.7	0.8	*1	*7	*8	*9	*11	*1	*12	*12	
3E43-1	55	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
3E44-1	56	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
3E54-1	58	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
3E55-1	59	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
3E56-1	60	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	2.4	*12	*12	
4E1-1	62	0.6	4.7	*3	4.3	1.0	*1	*7	*8	*9	*11	1.0	*12	*12	
4E2-1	63	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
4E3-1	64	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
4E4-1	65	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
4E5-1	66	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
4E6-1	67	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
4E7-1	68	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
4E23-1	69	0.6	4.4	*3	4.3	1.0	*1	*7	*8	*9	*11	*1	*12	*12	
4E24-1	70	0.8	6.2	*3	2.4	0.8	*1	*7	*8	*9	*11	*1	*12	*12	
4E25-1	71	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
4E26-1	72	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
4E27-1	73	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
4E28-1	74	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
4E29-1	75	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
5E1-1	76	0.6	4.4	*3	4.3	1.0	*1	*7	*8	*9	*11	*1	*12	*12	

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

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\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr No.	Survey No.	ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)																							
		ECO 16		ECO 17		ECO 18		ECO 19		ECO 20		ECO 21		ECO 24		ECO 25		ECO 28		ECO 29		ECO 30		ECO 33	
		Low Burner	Replic X-air Burner	Replic Burner	Insul Boiler	Fire Boiler	M. U. Tube	Auto Water	Blow down	O2 Ctrl	Air Trim	Atomiz ation	Elim Stm	Vari Aux	Insul fans	Oil Storag									
9E5-1	36	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
9E6-1	37	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
9E7-1	38	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
9E8-1	39	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21												
9E23-1	40	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21												
9E24-1	41	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
9E25-1	42	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
9E26-1	43	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
9E27-1	44	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
9E28-1	45	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
9E29-1	46	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
9E30-1	47	*13	0.1	0.9	0.1	*1	*9	*9	*17	*18	*19	*20	*21												
2E1-1	49	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
3E6-1	50	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
3E12-1	51	*13	0.4	1.0	0.3	*1	*9	*9	*17	*18	*19	*20	*21												
3E15-1	52	*13	0.2	1.7	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
3E16-1	53	*13	0.2	1.7	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
3E38-1	54	*13	0.4	0.7	0.3	0.5	*9	*9	*17	*18	*19	*20	*21												
3E43-1	55	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
3E44-1	56	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
3E54-1	58	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
3E55-1	59	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
3E56-1	60	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E1-1	62	*13	0.3	0.9	0.4	*1	*9	*9	*17	*18	*19	*20	*21												
4E2-1	63	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E3-1	64	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E4-1	65	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E5-1	66	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E6-1	67	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E7-1	68	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E23-1	69	*13	0.3	0.9	0.4	*1	*9	*9	*17	*18	*19	*20	*21												
4E24-1	70	*13	0.5	1.0	0.3	*1	*9	*9	*17	*18	*19	*20	*21												
4E25-1	71	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E26-1	72	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E27-1	73	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E28-1	74	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
4E29-1	75	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21												
5E1-1	76	*13	0.3	0.9	0.4	*1	*9	*9	*17	*18	*19	*20	*21												

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

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TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr Survey No.	No.	ECO 1 Blr	ECO 4 Blr	ECO 5 Opti-	ECO 6 Replc	ECO 7 Blr	ECO 8 Sensbl	ECO 9 Total	ECO 10 Pre-	ECO 11 Blwdn	ECO 12 Reduce	ECO 13 Flue	ECO 14 Baro-	ECO 15 Draft	
		Tune up	Refur- bshmt	mize	with hours	Shut Smaller	heat Down	heat recvy	heat recvy	C-air	Recvy	Heat trat'n	Dmprs	Dmprs	Cntrl Mods
5E2-1	77	1.2	9.0	*3	4.3	2.0	0.2	*7	*8	*9	*11	*1	*12	*12	
5E3-1	78	1.2	8.9	*3	4.2	1.7	0.1	*7	*8	*9	*11	*1	*12	*12	
5E4-1	79	0.8	4.4	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
5E5-1	80	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
5E6-1	81	0.8	4.4	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
5E7-1	82	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
5E23-1	83	0.8	5.0	*3	2.3	1.0	*1	*7	*8	*9	*11	*1	*12	*12	
5E24-1	84	0.5	4.0	*3	3.7	0.8	*1	*7	*8	*9	*11	*1	*12	*12	
5E25-1	85	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
5E26-1	86	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
5E27-1	87	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
5E28-1	88	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
5E29-1	89	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E1-1	90	0.6	4.4	*3	4.3	1.0	*1	*7	*8	*9	*11	2.6	*12	*12	
6E2-1	91	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E3-1	92	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E4-1	93	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E5-1	94	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E6-1	95	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E23-1	97	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E24-1	98	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E25-1	99	0.8	4.3	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E26-1	100	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E27-1	101	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E28-1	102	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6E29-1	103	0.8	4.7	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
1E15-1	104	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
1E20-1	105	6.6	9.5	*3	*4	0.6	0.2	*7	*8	*9	*11	*1	*12	*12	
1E40-1	106	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
1E47-1	107	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
1E55-1	108	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
6A2-1	115	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
6A3-1	116	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
6A4-1	117	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
6A6-1	118	0.7	2.7	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
6A7-1	119	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12	
6A32-1	120	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	
6A33-1	121	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12	

Notes: ECO's 2, 3, 22, 26, 27, 31, 32, and 34 did not have boiler specific results.

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Bldg-Blr No.	Survey No.	ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)												
		ECO 16	ECO 17	ECO 18	ECO 19	ECO 20	ECO 21	ECO 24	ECO 25	ECO 28	ECO 29	ECO 30	ECO 33	
		Low Burner	Replc X-air Burner	Replc Boiler	Insul Boiler	Fire Tube	M. U. Water	Auto Blow down	O2 Trim Ctrl	Air Atomiz ation	Elim Stm	Vari speed	Insul fans	Oil Storag
5E2-1	77	*13	0.6	1.5	0.7	0.4	*9	*9	*17	*18	*19	*20	*21	
5E3-1	78	*13	0.6	1.4	0.7	0.4	*9	*9	*17	*18	*19	*20	*21	
5E4-1	79	*13	0.3	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
5E5-1	80	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
5E6-1	81	*13	0.3	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
5E7-1	82	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
5E23-1	83	*13	0.4	1.0	0.3	*1	*9	*9	*17	*18	*19	*20	*21	
5E24-1	84	*13	0.3	0.8	0.3	*1	*9	*9	*17	*18	*19	*20	*21	
5E25-1	85	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
5E26-1	86	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
5E27-1	87	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
5E28-1	88	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
5E29-1	89	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E1-1	90	*13	0.3	0.9	0.4	*1	*9	*9	*17	*18	*19	*20	*21	
6E2-1	91	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E3-1	92	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E4-1	93	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E5-1	94	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E6-1	95	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E23-1	97	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
74-1	98	*13	0.3	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E25-1	99	*13	0.3	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E26-1	100	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E27-1	101	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E28-1	102	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6E29-1	103	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
1E15-1	104	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
1E20-1	105	*13	0.7	0.8	0.2	*16	*9	*9	*17	*18	*19	*20	*21	
1E40-1	106	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
1E47-1	107	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
1E55-1	108	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6A2-1	115	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6A3-1	116	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6A4-1	117	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6A6-1	118	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6A7-1	119	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6A32-1	120	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
6A33-1	121	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21	

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TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr Survey No.	No.	ECO 1 Blr	ECO 4 Blr	ECO 5 Opti-	ECO 6 Replic	ECO 7 Blr	ECO 8 Sensbl	ECO 9 Total	ECO 10 Pre-	ECO 11 Blwdn	ECO 12 Reduce	ECO 13 Heat Infil-	ECO 14 Gas metric	ECO 15 Baro- Draft Cntrl Mod
		Tune up	Refur- bshmt	mize with hours	smaller	Shut Down	heat recvy	heat recvy	C-air	Recvy	trat'n	Dmprs	Dmprs	
6A36-1	122	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
6A37-1	123	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
6A38-1	124	0.3	0.6	*3	*4	0.3	*1	*7	*8	*9	*11	*1	*1	*12
6A39-1	125	0.4	0.7	*3	*4	0.3	*1	*7	*8	*9	*11	*1	*12	*12
6A40-1	126	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
6A41-1	127	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
8A2-1	128	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
8A3-1	129	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
8A6-1	130	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
8A7-1	131	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
8A27-1	132	0.6	4.4	*3	4.3	1.0	*1	*7	*8	*9	*11	3.6	*12	*12
8A28-1	133	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
8A29-1	134	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
8A32-1	135	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
8A33-1	136	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
9A1-1	137	0.8	5.2	*3	2.3	1.0	*1	*7	*8	*9	*11	*1	*12	*12
9A2-1	138	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
9A3-1	139	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
9A6-1	140	0.7	2.8	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
9A7-1	141	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
9A8-1	142	0.6	4.4	*3	4.3	1.0	*1	*7	*8	*9	*11	1.0	*12	*12
9A28-1	143	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
9A29-1	144	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
9A32-1	145	0.7	3.0	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
9A33-1	146	0.7	2.9	*3	1.9	0.5	*1	*7	*8	*9	*11	*1	*12	*12
10B8-1	148	3.5	11.6	*3	1.3	*5	*1	*7	*8	*9	*11	1.6	*12	*1
9D30-1	153	1.1	1.9	*3	*4	0.5	0.1	*7	*8	*9	*11	*1	*12	*12
9D38-1	154	1.1	1.9	*3	*4	0.5	0.1	*7	*8	*9	*11	*1	*12	*12
1010-1	157	3.2	3.8	*3	*4	3.8	0.5	*7	*8	*9	*11	*1	*12	*12
1017-1	159	3.7	5.6	*3	*4	6.0	*1	*7	*8	*9	*11	*1	*12	*12
1020-1	160	*2	1.3	*3	*4	1.3	*1	*7	*8	*9	*11	*1	*12	*12
1033-1	161	9.3	12.6	*3	*4	4.2	0.3	*7	*8	*9	0.3	*1	*12	*12
1034-1	162	2.1	9.1	*3	*4	1.0	0.6	*7	*8	*9	*11	*1	*12	*12
1036-1	163	1.7	2.9	*3	*4	0.3	0.5	*7	*8	*9	*11	*1	*12	*12
1037-1	164	1.7	2.9	*3	*4	0.3	0.5	*7	*8	*9	*11	*1	*12	*12
1227-1	167	3.6	4.0	*3	*4	2.9	0.3	*7	*8	*9	*11	4.6	*12	*12
1501-1	173	5.2	9.6	*3	0.8	*5	*1	*7	*8	*9	0.2	*1	*12	*12
2003-1	175	2.6	4.1	*3	*4	*5	0.4	*7	*8	*9	*11	*1	*1	*12

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr No.	Survey No.	ECO 16 ECO 17 ECO 18 ECO 19 ECO 20 ECO 21 ECO 24 ECO 25 ECO 28 ECO 29 ECO 30 ECO 33											
		Low Burner	Replic X-air	Replic Burner	Insul Boiler	Fire Boiler	M. U. Tube	Auto Water	O2 Blow down	Air Trim	Elim Atomiz Ctrl	Vari Stm	Insul speed Aux
6A36-1	122	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
6A37-1	123	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
6A38-1	124	*13	0.1	1.5	0.1	*1	*9	*9	*17	*18	*19	*20	*21
6A39-1	125	*13	0.1	1.5	0.1	*1	*9	*9	*17	*18	*19	*20	*21
6A40-1	126	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
6A41-1	127	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
8A2-1	128	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
8A3-1	129	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
8A6-1	130	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
8A7-1	131	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
8A27-1	132	*13	0.3	0.9	0.4	*1	*9	*9	*17	*18	*19	*20	*21
8A28-1	133	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
8A29-1	134	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
8A32-1	135	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
8A33-1	136	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
9A1-1	137	*13	0.4	1.0	0.3	*1	*9	*9	*17	*18	*19	*20	*21
9A2-1	138	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
9A3-1	139	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
9A6-1	140	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
9A7-1	141	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
9A8-1	142	*13	0.3	0.9	0.4	*1	*9	*9	*17	*18	*19	*20	*21
9A28-1	143	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
9A29-1	144	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
9A32-1	145	*13	0.3	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
9A33-1	146	*13	0.2	1.8	0.2	*1	*9	*9	*17	*18	*19	*20	*21
10B8-1	148	*13	0.8	0.7	0.6	0.2	*9	*9	*17	*18	*19	*20	*21
9D30-1	153	*13	0.1	1.3	0.2	0.3	*9	*9	*17	*18	*19	*20	*21
9D38-1	154	*13	0.1	1.3	0.2	0.3	*9	*9	*17	*18	*19	*20	*21
1010-1	157	*13	0.2	1.1	0.5	*16	*9	*9	*17	*18	*19	*20	*21
1017-1	159	*13	0.4	1.1	0.8	*16	*9	*9	*17	*18	*19	*20	*21
1020-1	160	*13	0.2	0.3	0.4	*1	*9	*9	*17	*18	*19	*20	*21
1033-1	161	*13	0.9	1.0	0.5	*16	*9	*9	*17	*18	*19	*20	*21
1034-1	162	*13	0.7	1.0	0.4	*16	*9	*9	*17	*18	*19	*20	*21
1036-1	163	*13	0.1	2.8	0.1	*16	*9	*9	*17	*18	*19	*20	*21
1037-1	164	*13	0.1	2.8	0.1	*16	*9	*9	*17	*18	*19	*20	*21
1227-1	167	*13	0.3	1.0	0.3	1.8	*9	*9	*17	*18	*19	*20	*21
1501-1	173	*13	0.7	0.7	0.4	*16	*9	*9	*17	*18	*19	*20	*21
2003-1	175	*13	0.2	1.0	0.3	*16	*9	*9	*17	*18	*19	*20	*21

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Bldg-Blr No.	Survey No.	ECO 1 Blr	ECO 4 Blr	ECO 5 Opti-	ECO 6 Replc	ECO 7 Blr	ECO 8 Sensbl	ECO 9 Total	ECO 10 Pre-	ECO 11 Blwdn	ECO 12 Reduce	ECO 13 Flue	ECO 14 Baro-	ECO 15 Draft	
		Tune up	Refur- bshmt	mize	with	hours	Smaller	Shut Down	heat recvy	heat recvy	C-air	Recvy	Heat Infil-	Gas metric	Cntrl Mod
2006-1	177	21.8	14.0	*3	*4		*5	*6	*7	*8	*9	*11	*12	*12	*12
2012-1	178	16.5	18.9	*3	*4		*5	0.9	*7	*8	*9	*11	*1	*12	*1
2013-1	179	16.5	18.9	*3	*4		*5	0.9	*7	*8	*9	*11	5.2	*12	*1
2014-1	180	1.5	11.6	*3	1.4		*5	0.8	*7	*8	*9	*11	*1	*12	*12
2015A-1	181	9.2	10.9	*3	*4		*5	*6	*7	*8	*9	*11	*1	1.8	*12
2015B-1	182	22.7	20.1	*3	*4		1.4	1.3	*7	*8	*9	*11	*1	*1	*12
2019A-1	183	16.9	16.0	*3	*4		1.4	0.9	*7	*8	*9	*11	*1	*1	*12
2019B-2	183	16.9	16.0	*3	*4		1.4	0.9	*7	*8	*9	*11	*1	*1	*12
2020A-1	184	30.3	21.3	*3	*4		*5	1.8	*7	*8	*9	*11	*1	4.0	1.6
2020B-1	185	14.2	12.7	*3	*4		*5	*6	*7	*8	*9	*11	*1	2.1	0.8
2020C-1	186	30.3	21.3	*3	*4		*5	1.8	*7	*8	*9	*11	*1	4.0	1.6
2020D-1	187	55.3	38.0	*3	*4		1.7	2.3	*7	*8	*9	*11	*12	4.7	*12
2021A-1	188	26.2	19.6	*3	*4		1.4	1.7	*7	*8	*9	*11	*12	3.8	*12
2021B-1	189	54.4	37.4	*3	*4		1.7	2.3	*7	*8	*9	*11	*12	4.6	*12
2021C-1	190	26.2	19.6	*3	*4		1.4	1.7	*7	*8	*9	*11	*12	3.8	*12
2021D-1	191	26.2	19.6	*3	*4		1.4	1.7	*7	*8	*9	*11	*12	3.8	*12
2103-1	199	2.9	8.1	*3	1.1		1.9	0.6	*7	*8	*9	*11	*1	*1	*12
2109-1	200	6.9	9.8	*3	*4		1.0	0.3	*7	*8	*9	*11	*1	*1	*12
2110-1	201	9.5	25.1	*3	2.4		*5	1.4	*7	*8	*9	*11	*1	2.0	0.8
2140-1	203	14.6	18.0	*3	*4		*5	0.9	*7	*8	*9	*11	*1	2.0	0.8
2150-1	204	2.5	17.8	*3	2.2		*5	0.5	*7	*8	*9	*11	*1	*1	*1
2400-1	210	2.1	18.1	*3	1.8		*5	0.4	*7	*8	*9	*11	*1	*1	*1
4174-1	222	4.2	5.1	*3	*4		5.3	0.6	*7	*8	*9	*11	1.5	*12	*12
4290-1	226	18.3	17.0	*3	*4		*5	0.9	*7	*8	*9	*11	*1	*1	*1
4290-2	226	18.3	17.0	*3	*4		*5	0.9	*7	*8	*9	*11	*1	*1	*1
4291-1	227	1.3	5.6	*3	0.7		1.0	*1	*7	*8	*9	*11	*1	*12	*12
4320-1	229	*2	27.4	*3	2.6		*5	2.0	*7	*8	*9	*11	*1	*12	*12
4431-1	231	0.7	1.7	*3	*4		0.4	*1	*7	*8	*9	*11	*1	*12	*12
4432-1	232	0.8	4.7	*3	0.6		0.6	*1	*7	*8	*9	*11	*1	*12	*12
4433-1	233	0.8	4.6	*3	2.1		0.6	*1	*7	*8	*9	*11	*1	*12	*12
4434-1	234	0.8	4.5	*3	2.1		0.6	*1	*7	*8	*9	*11	*1	*12	*12
4435-1	235	0.8	4.6	*3	2.1		0.6	*1	*7	*8	*9	*11	*1	*12	*12
4436-1	236	0.4	1.5	*3	1.9		0.4	*1	*7	*8	*9	*11	*1	*12	*12
4437-1	237	0.5	4.0	*3	3.8		0.8	*1	*7	*8	*9	*11	*1	*12	*12
4444-1	238	0.4	1.5	*3	1.9		0.4	*1	*7	*8	*9	*11	*1	*12	*12
4445-1	239	0.4	1.5	*3	1.9		0.4	*1	*7	*8	*9	*11	*1	*12	*12
4446-1	240	0.8	4.5	*3	2.1		0.6	*1	*7	*8	*9	*11	*1	*12	*12
4447-1	241	0.8	4.6	*3	2.1		0.6	*1	*7	*8	*9	*11	*1	*12	*12

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Bldg-Blr No.	Survey No.	ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)												
		ECO 16	ECO 17	ECO 18	ECO 19	ECO 20	ECO 21	ECO 24	ECO 25	ECO 28	ECO 29	ECO 30	ECO 33	
		Low Burner	Replc Burner	Replc Boiler	Insul Boiler	Fire Tube	M. U. Water	Auto Blow	O2 Ctrl	Air Trim	Elim Atomiz	Vari Stm	Oil fans	Insul Storag
2006-1	177	*13	1.3	1.3	0.4	*16	*9	*9	*17	*18	*19	*20	*21	
2012-1	178	*13	1.3	1.7	0.5	3.2	*9	*9	*17	*18	*19	*20	*21	
2013-1	179	*13	1.4	1.7	0.5	3.2	*9	*9	*17	*18	*19	*20	*21	
2014-1	180	*13	0.8	1.1	0.6	0.6	*9	*9	*17	*18	*19	*20	*21	
2015A-1	181	*13	0.9	1.1	0.4	*16	*9	*9	*17	*18	*19	*20	*21	
2015B-1	182	*13	1.4	2.3	0.4	5.0	*9	*9	*17	*18	*19	*20	*21	
2019A-1	183	*13	1.2	1.8	0.4	2.9	*9	*9	*17	*18	*19	*20	*21	
2019B-2	183	*13	1.3	1.8	0.4	2.9	*9	*9	*17	*18	*19	*20	*21	
2020A-1	184	*13	1.5	3.0	0.4	7.4	*9	*9	*17	*18	*19	*20	*21	
2020B-1	185	*13	1.0	1.1	0.4	*16	*9	*9	*17	*18	*19	*20	*21	
2020C-1	186	*13	1.5	3.0	0.4	7.4	*9	*9	*17	*18	*19	*20	*21	
2020D-1	187	*13	2.8	4.1	0.5	*16	*9	*9	*17	*18	*19	*20	*21	
2021A-1	188	*13	1.4	3.0	0.4	7.6	*9	*9	*17	*18	*19	*20	*21	
2021B-1	189	*13	2.7	4.1	0.5	*16	*9	*9	*17	*18	*19	*20	*21	
2021C-1	190	*13	1.4	3.0	0.4	7.6	*9	*9	*17	*18	*19	*20	*21	
2021D-1	191	*13	1.4	3.0	0.4	7.6	*9	*9	*17	*18	*19	*20	*21	
2103-1	199	*13	0.7	1.1	0.3	*16	*9	*9	*17	*18	*19	*20	*21	
2109-1	200	*13	0.6	1.0	0.2	1.0	*9	*9	*17	*18	*19	*20	*21	
2110-1	201	*13	1.8	2.0	0.5	*16	*9	*9	*17	*18	*19	*20	*21	
2140-1	203	*13	1.7	2.0	0.5	3.8	*9	*9	*17	*18	*19	*20	*21	
2150-1	204	*13	1.2	1.1	0.6	1.2	*9	*9	*17	*18	*19	*20	*21	
2400-1	210	*13	1.2	0.8	0.4	0.5	*9	*9	*17	*18	*19	*20	*21	
4174-1	222	*13	0.3	1.1	0.6	*16	*9	*9	*17	*18	*19	*20	*21	
4290-1	226	*13	1.3	1.7	0.5	2.7	*9	*9	*17	*18	*19	*20	*21	
4290-2	226	*13	1.3	1.7	0.5	2.7	*9	*9	*17	*18	*19	*20	*21	
4291-1	227	*13	0.5	0.6	0.3	*1	*9	*9	*17	*18	*19	*20	*21	
4320-1	229	*13	2.2	1.5	0.4	*16	*9	*9	*17	*18	*19	*20	*21	
4431-1	231	*13	0.2	1.6	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
4432-1	232	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
4433-1	233	*13	0.4	0.9	0.3	*1	*9	*9	*17	*18	*19	*20	*21	
4434-1	234	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
4435-1	235	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
4436-1	236	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
4437-1	237	*13	0.3	0.8	0.3	*1	*9	*9	*17	*18	*19	*20	*21	
4444-1	238	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
4445-1	239	*13	0.1	1.0	0.1	*1	*9	*9	*17	*18	*19	*20	*21	
4446-1	240	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	
4447-1	241	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21	

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr Survey No.	No.	ECO 1 Blr	ECO 4 Blr	ECO 5 Opti-	ECO 6 Replc	ECO 7 Blr	ECO 8 Sensbl	Total Shut Down	Pre-heat recvy	ECO 9 heat recvy	ECO 10 C-air Recvy	ECO 11 Heat trat'n	ECO 12 Infil-	ECO 13 Gas	ECO 14 metric	ECO 15 Baro- Draft Cntrl Mods
4448-1	242	0.8	4.5	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12		
4449-1	243	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12		
4450-1	244	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12		
4451-1	245	0.8	4.6	*3	2.1	0.6	*1	*7	*8	*9	*11	*1	*12	*12		
4548-1	249	0.4	0.6	*3	*4	0.5	*1	*7	*8	*9	*11	*1	*12	*12		
6071-1	254	1.0	1.8	*3	*4	*5	0.2	*7	*8	*9	*11	*1	*12	*12		
7500-1	259	30.9	75.9	*3	6.7	*5	5.4	*7	*8	*9	9.7	5.1	*12	1.6		
7500-2	259	16.7	92.1	*3	6.2	*5	4.2	*7	*8	*9	*11	*1	7.9	3.2		
9503-1	262	6.9	10.5	*3	0.9	*5	*6	*7	*1	*9	1.0	4.5	*12	*1		
9670-1	273	16.1	8.5	*3	*4	1.8	3.4	*7	0.6	*9	*11	*1	*12	*12		
2007A-1	278	13.4	12.6	*3	*4	0.9	0.7	*7	*8	*9	*11	*1	*1	*12		
2007B-2	278	13.4	12.6	*3	*4	0.9	0.7	*7	*8	*9	*11	*1	*12			
2007C-3	278	13.4	12.6	*3	*4	0.9	0.7	*7	*8	*9	*11	*1	*12			
2008A-1	279	3.0	3.8	*3	*4	0.8	0.6	*7	*8	*9	*11	*1	*12	*12		
2008B-2	279	3.6	4.5	*3	*4	0.6	2.5	*7	*8	*9	*11	*1	*12	*12		
2008C-3	279	13.4	12.6	*3	*4	0.9	0.7	*7	*8	*9	*11	*1	*1	*12		
3E53-1	280	2.0	3.4	*3	*4	0.7	0.3	*7	*8	*9	0.4	*1	*12	*12		

## STEAM BOILERS:

IJ8-1	48	19.7	18.5	*3	*4	*5	1.0	*7	*8	*1	*11	1.0	*12	*1		
3E48-1	57	5.4	11.3	*3	2.2	*5	*1	*7	*8	*1	0.3	13.0	*12	*12		
3E90-1	61	0.6	4.1	*3	3.2	*5	*1	*7	*8	*1	*11	9.5	*12	*12		
2A15-1	109	1.0	16.9	*3	3.4	*5	0.8	*7	*8	*1	*11	*1	*1	*1		
3A2-1	110	7.5	17.5	*3	2.0	*5	0.3	*7	*8	*1	*11	1.8	*1	*1		
3A3-1	111	1.2	9.9	*3	1.5	*5	1.0	*7	*8	*1	*11	0.9	*1	*12		
3A10-1	112	4.7	5.4	*3	*4	*5	0.5	*7	*8	*1	*11	5.4	3.0	1.1		
3A35-1	113	9.3	16.3	*3	1.4	*5	0.3	*7	*8	*1	*11	*1	*12	*1		
3A38-1	114	7.4	15.4	*3	3.8	*5	0.2	*7	*8	*1	0.5	16.6	*12	*12		
14A26-1	147	5.4	14.6	*3	1.2	*5	0.4	*7	*8	*1	*11	10.7	*12	*1		
11B29-1	149	6.0	12.8	*3	3.7	*5	0.1	*7	*8	*1	0.4	20.8	*12	*12		
3C30-1	150	6.0	12.9	*3	3.6	*5	0.1	*7	*8	*1	0.6	21.2	*12			
13C53-1	151	7.1	16.2	*3	1.4	*5	0.6	*7	*8	*1	*11	2.8	*12	*12		
6D35-1	152	2.9	13.3	*3	2.1	*5	0.2	*7	*8	*1	1.0	37.8	*1	*1		
11D47-1	156	6.1	12.9	*3	3.6	*5	0.1	*7	*8	*1	*11	13.5	*12	*12		

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

TABLE E-1

ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr No.	Survey No.	ECO 16	ECO 17	ECO 18	ECO 19	ECO 20	ECO 21	ECO 24	ECO 25	ECO 28	ECO 29	ECO 30	ECO 33
		Low Burner	Replc X-air Burner	Replc Boiler	Insul Boiler	Fire Tube	M. U. Water	Auto Blow down	O2 Ctrl	Air Trim	Atomiz ation	Elim Stm	Vari Oil fans Storag
4448-1	242	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21
4449-1	243	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21
4450-1	244	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21
4451-1	245	*13	0.4	0.9	0.2	*1	*9	*9	*17	*18	*19	*20	*21
4548-1	249	*13	0.0	1.7	0.1	*16	*9	*9	*17	*18	*19	*20	*21
6071-1	254	*13	0.1	1.0	0.1	*16	*9	*9	*17	*18	*19	*20	*21
7500-1	259	*13	6.7	4.2	0.7	*16	*9	*9	*17	*18	*19	*20	*21
7500-2	259	*13	6.2	3.4	0.8	*16	*9	*9	*17	*18	*19	*20	*21
9503-1	262	*13	1.0	0.7	0.6	*16	*9	*9	*17	*18	*19	*20	*21
9670-1	273	*13	0.5	4.8	0.2	19.6	*9	*9	*17	*18	*19	*20	*21
2007A-1	278	*13	1.0	1.7	0.3	2.5	*9	*9	*17	*18	*19	*20	*21
2007B-2	278	*13	1.0	1.7	0.3	2.5	*9	*9	*17	*18	*19	*20	*21
2007C-3	278	*13	1.0	1.7	0.3	2.5	*9	*9	*17	*18	*19	*20	*21
2008A-1	279	*13	0.2	1.2	0.3	2.8	*9	*9	*17	*18	*19	*20	*21
2008B-2	279	*13	0.0	2.1	0.2	3.2	*9	*9	*17	*18	*19	*20	*21
2008C-3	279	*13	1.0	1.7	0.3	2.5	*9	*9	*17	*18	*19	*20	*21
3E53-1	280	*13	0.1	1.8	0.2	1.5	*9	*9	*17	*18	*19	*20	*21

## STEAM BOILERS:

IJ8-1	48	*13	1.7	1.8	0.5	2.7	*1	*1	*17	*18	*19	*20	*21
3E48-1	57	*13	0.8	0.8	0.4	*16	*1	*1	*17	*18	*19	*20	*21
3E90-1	61	*13	0.3	0.4	0.4	*1	*1	*1	*17	*18	*19	*20	*21
2A15-1	109	*13	1.1	1.1	0.6	0.6	*1	*1	*17	*18	*19	*20	*21
3A2-1	110	*13	1.3	0.6	0.6	0.5	*1	*1	*17	*18	*19	*20	*21
3A3-1	111	*13	0.7	1.2	0.6	0.9	*1	*1	*17	*18	*19	*20	*21
3A10-1	112	*13	0.7	0.9	0.3	1.5	*1	*1	*17	*18	*19	*20	*21
3A35-1	113	*13	1.2	0.9	0.5	0.7	*1	*1	*17	*18	*19	*20	*21
3A38-1	114	*13	1.1	0.9	0.8	*16	*1	*1	*17	*18	*19	*20	*21
14A26-1	147	*13	1.4	0.9	0.4	1.4	*1	*1	*17	*18	*19	*20	*21
11B29-1	149	*13	0.9	0.8	0.9	*16	*1	*1	*17	*18	*19	*20	*21
3C30-1	150	*13	0.9	0.8	0.8	*16	*1	*1	*17	*18	*19	*20	*21
13C53-1	151	*13	1.1	1.1	0.5	*16	*1	*1	*17	*18	*19	*20	*21
6D35-1	152	*13	0.9	0.8	0.6	0.6	*1	*1	*17	*18	*19	*20	*21
11D47-1	156	*13	0.9	0.8	0.8	*16	*1	*1	*17	*18	*19	*20	*21

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr Survey No.	No.	ECO 1 Blr	ECO 4 Blr	ECO 5 Opti-	ECO 6 Replc	ECO 7 Blr	ECO 8 Sensbl	ECO 9 Total	ECO 10 Pre-	ECO 11 Blwdn	ECO 12 Reduce	ECO 13 Flue	ECO 14 Baro-	ECO 15 Draft
		Tune up	Refur- bshmt	mize	with hours	Shut Smaller	recvy	heat recvy	heat C-air	heat Recvy	Heat trat'n	Gas Dmprs	metric Dmprs	Cntrl Mods
1015-1	158	2.3	4.1	*3	*4	*5	0.3	*7	*8	*1	*11	2.0	*1	*12
1161-1	165	8.1	10.3	*3	*4	*5	*6	*7	0.4	*1	*11	5.7	*1	*1
1163-1	166	16.7	15.5	*3	*4	*5	0.6	*7	*1	*1	*11	3.6	*12	*12
1163-2	166	16.7	15.5	*3	*4	*5	0.6	*7	*1	*1	*11	*12	*12	*12
1401-1	169	37.9	26.6	*3	3.7	*5	*6	*7	*8	*1	*11	*12	7.2	*12
2004-1	176	2.2	8.3	*3	1.2	*5	0.3	*7	*8	*1	*11	3.8	*1	*12
2022-1	192	3.6	6.2	*3	0.8	*5	*6	*7	*8	*1	*11	2.1	*1	*1
2022-2	192	3.6	6.2	*3	0.8	*5	*6	*7	*8	*1	*11	14.3	*1	*1
2027-1	195	1.6	4.1	*3	0.4	*5	*1	*1	*8	*1	*11	14.4	*1	*1
2027-2	195	1.3	1.7	*3	*4	*5	*1	*1	*8	*1	*11	4.2	*1	*1
2045-1	196	4.1	4.9	*3	*4	*5	*6	*7	*8	*1	*11	3.2	0.6	0.3
2054-1	197	40.8	33.9	*3	*4	*5	2.5	*7	1.5	*1	*11	1.1	2.6	1.0
2068-1	198	1.9	3.7	*3	2.3	*5	*6	*7	*8	*1	*11	*1	*1	*1
2166-1	206	48.7	50.6	*3	*4	*5	2.4	*7	1.5	*1	*11	2.7	3.0	1.2
2202-1	207	28.8	25.2	*3	*4	*5	1.7	*7	*8	*1	*11	*1	*12	0.3
2270-1	208	6.0	12.8	*3	3.6	*5	0.1	*7	*8	*1	0.4	*1	*12	*12
2493-1	212	6.5	13.3	*3	1.6	*5	*6	*7	*8	*1	*11	18.1	*12	*1
3725-1	213	6.0	12.8	*3	3.6	*5	0.1	*7	*8	*1	0.4	16.5	*12	*12
4071-1	217	8.0	9.7	*3	*4	*5	*6	*7	*8	*1	1.8	18.2	*1	*1
4074-1	218	0.8	3.0	*3	0.7	*5	*1	*7	*8	*1	0.1	11.9	*12	*12
4076-1	219	8.3	11.7	*3	0.9	*5	*1	*7	*8	*1	0.6	8.7	*1	*1
4127-1	221	1.0	8.8	*3	2.5	*5	0.1	*7	*8	*1	*11	30.5	*12	*12
4218-1	223	4.0	8.7	*3	1.6	*5	*1	*7	*8	*1	*11	5.9	*1	*12
4274-1	225	4.0	9.0	*3	2.1	*5	*1	*7	*8	*1	*11	*1	*1	*12
4292-1	228	5.3	11.2	*3	2.2	*5	0.1	*7	*8		*11	7.4	*1	*12
4336-1	230	1.3	8.0	*3	1.3	*5	*1	*7	*8	*1	0.5	*1	*1	*12
5137-1	250	1.5	2.1	*3	*4	*5	0.2	*7	*8	*1	*11	23.2	*12	*12
5182-1	251	1.4	9.2	*3	2.7	*5	*1	*7	*8	*1	*11	*12	*1	*12
5209-1	252	1.6	10.0	*3	3.1	*5	0.1	*7	*8	*1	*11	*12	*1	*12
5227-1	253	2.5	13.2	*3	1.5	*5	0.3	*7	*8	*1	*11	*1	*1	*12
6133-1	256	0.9	1.5	*3	*4	*5	0.1	*7	*8	*1	0.4	2.0	*1	*12
6165-1	257	0.8	1.4	*3	*4	*5	*1	*7	*8	*1	0.4	1.9	*1	*12
6203-1	258	0.9	1.5	*3	*4	*5	0.1	*7	*8	*1	0.4	6.8	*1	*12
8085-1	260	2.9	6.4	*3	0.7	*5	*1	*1	*8	*1		3.6	*1	*1
9500-1	261	36.4	46.7	*3	1.8	*5	1.9	*7	0.8	*1	1.2	*12	*12	*12
9504-1	263	5.8	11.5	*3	1.1	*5	*1	*7	*8	*1	*11	*12	*12	*12
9550-1	265	0.5	4.3	*3	4.0	*5	*1	*7	*8	*1	*11	*12	*12	*12
9620-1	267	12.1	10.6	*3	*4	*5	3.2	*7	*8	*1	*11	*12	5.3	2.1

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr No.	Survey No.	ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)											
		ECO 16	ECO 17	ECO 18	ECO 19	ECO 20	ECO 21	ECO 24	ECO 25	ECO 28	ECO 29	ECO 30	ECO 33
		Low X-air Burner	Replc Burner	Replc Boiler	Insul Boiler	Fire Tube	M. U. Water	Auto Blow down	O2 Trim Ctrl	Air Atomiz ation	Elim Stm	Vari speed	Oil fans Storag
1015-1	158	*13	0.4	0.9	0.4	*16	*1	*1	*17	*18	*19	*20	*21
1161-1	165	*13	1.0	0.8	0.6	*16	*1	*1	*17	*18	*19	*20	*21
1163-1	166	*13	1.4	1.4	0.2	*16	*1	*1	*17	*18	*19	*20	*21
1163-2	166	*13	1.4	1.4	0.2	*16	*1	*1	*17	*18	*19	*20	*21
1401-1	169	2.6	2.6	1.4	0.5	*16	*1	*1	*17	*18	*19	*20	*21
2004-1	176	*13	0.6	0.8	0.6	*16	*1	*1	*17	*18	*19	*20	*21
2022-1	192	*13	0.6	0.4	0.3	*16	*1	*1	*17	*18	*19	*20	*21
2022-2	192	*13	0.6	0.4	0.3	*16	*1	*1	*17	*18	*19	*20	*21
2027-1	195	*13	0.4	0.2	0.2	*16	*1	*1	*17	*18	*19	*20	*21
2027-2	195	*13	0.2	0.1	0.2	*16	*1	*1	*17	*18	*19	*20	*21
2045-1	196	*13	0.4	0.6	0.3	*16	*1	*1	*17	*18	*19	*20	*21
2054-1	197	*13	3.0	3.0	0.4	8.8	*1	*1	*17	*18	*19	*20	*21
2068-1	198	*13	0.3	0.5	0.4	*16	*1	*1	*17	*18	*19	*20	*21
2166-1	206	*13	4.4	2.1	0.5	5.8	*1	*1	*17	*18	*19	*20	*21
2202-1	207	*13	2.1	2.1	0.4	4.8	*1	*1	*17	*18	*19	*20	*21
2270-1	208	*13	0.9	0.8	0.8	*16	*1	*1	*17	*18	*19	*20	*21
2493-1	212	*13	1.1	0.8	0.4	*16	*1	*1	*17	*18	*19	*20	*21
3725-1	213	*13	0.9	0.8	0.8	*16	*1	*1	*17	*18	*19	*20	*21
4071-1	217	*13	0.8	1.0	0.4	*16	*1	*1	*17	*18	*19	*20	*21
4074-1	218	*13	0.3	0.6	0.4	*1	*1	*1	*17	*18	*19	*20	*21
4076-1	219	*13	1.1	0.7	0.4	*1	*1	*1	*17	*18	*19	*20	*21
4127-1	221	*13	0.6	0.7	0.6	*16	*1	*1	*17	*18	*19	*20	*21
4218-1	223	*13	0.6	0.6	0.3	*1	*1	*1	*17	*18	*19	*20	*21
4274-1	225	*13	0.6	0.5	0.4	*1	*1	*1	*17	*18	*19	*20	*21
4292-1	228	*13	0.8	0.7	0.4	*16	*1	*1	*17	*18	*19	*20	*21
4336-1	230	*13	0.6	0.7	0.6	*16	*1	*1	*17	*18	*19	*20	*21
5137-1	250	*13	0.2	0.6	0.3	*16	*1	*1	*17	*18	*19	*20	*21
5182-1	251	*13	0.6	0.7	0.5	0.3	*1	*1	*17	*18	*19	*20	*21
5209-1	252	*13	0.7	0.7	0.7	*16	*1	*1	*17	*18	*19	*20	*21
5227-1	253	*13	0.9	0.9	0.6	*16	*1	*1	*17	*18	*19	*20	*21
6133-1	256	*13	0.1	1.0	0.2	0.4	*1	*1	*17	*18	*19	*20	*21
6165-1	257	*13	0.2	1.0	0.1	0.3	*1	*1	*17	*18	*19	*20	*21
6203-1	258	*13	0.3	1.0	0.2	0.4	*1	*1	*17	*18	*19	*20	*21
8085-1	260	*13	0.7	0.3	0.3	*16	*1	*1	*17	*18	*19	*20	*21
9500-1	261	*13	5.3	1.4	0.5	3.9	*1	*1	*17	*18	*19	*20	*21
9504-1	263	*13	0.8	0.8	0.6	*16	*1	*1	*17	*18	*19	*20	*21
9550-1	265	*13	0.3	0.5	0.5	*1	*1	*1	*17	*18	*19	*20	*21
9620-1	267	*13	0.7	2.8	0.5	*16	*1	*1	*17	*18	*19	*20	*21

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr Survey No.	No.	ECO 1 Blr Tune up	ECO 4 Blr Refur- bshmt	ECO 5 Opti- mize	ECO 6 with hours	ECO 7 Smaller	ECO 8 Shut Down	ECO 9 heat recvy	ECO 10 heat recvy	ECO 11 C-air	ECO 12 Recvy	ECO 13 trat'n	ECO 14 Dmprs	ECO 15 Dmprs Mods
9641-1	269	*2	*2	*3	*4	*5	2.8	*7	*8	*1	*11	22.6	*12	*12
9641-2	269	8.3	10.0	*3	*4	*5	1.3	*7	*8	*1	1.9	4.4	1.7	0.7
9669-1	272	36.9	38.2	*3	*4	*5	1.7	*7	*8	*1	*11	*1	1.8	0.7
9997-1	275	7.7	11.5	*3	1.4	*5	*6	*7	*8	*1	1.8	1.0	*1	*1
9998-1	276	7.7	11.5	*3	1.4	*5	*6	*7	*8	*1	1.8	19.1	*1	*1
14A51-1	281	19.3	28.1	*3	2.3	*5	1.0	*7	*8	*10	0.7	2.1	*12	*1
2165-1	282	22.3	20.0	*3	*4	*5	1.3	*7	*8	*1	*11	17.3	*12	0.4
5172-1	283	7.7	15.8	*3	1.3	*5	0.4	*7	*8	*1	*11	18.4	*1	*1
5173-1	284	4.4	9.2	*3	0.8	*5	*1	*7	*8	*1	*11	18.8	*12	*12
6229-1	285	6.0	12.9	*3	3.6	*5	0.1	*7	*8	*1	*11	18.6	*12	*12
<b>MAIN PLANT BOILERS:</b>														
1263-1	168	35.0	29.6	*3	*4	*5	4.4	*7	1.2	*1	*11	7.9	6.0	3.0
1450-1	171	0.4	0.2	*3	*4	*5	*1	*1	*1	*1	*11	*12	*12	*1
1450-2	171	11.4	31.4	*3	3.6	*5	1.1	*7	0.7	*1	2.6	18.4	*12	0.2
1452-1	172	3.0	5.2	*3	1.3	*5	*6	*7	0.6	*1	1.2	18.4	*1	*1
1452-2	172	16.6	46.2	*3	3.9	*5	1.1	*7	0.7	*1	3.2	*12	2.9	1.4
2001-1	174	22.7	45.8	*3	4.0	*5	0.7	*7	*8	*9	*11	*1	0.6	0.3
2025-1	193	3.1	3.6	*3	*4	*5	0.1	*1	*8	*1	*11	1.2	*1	*1
2025-2	193	0.2	0.2	*3	*4	*5	*6	*7	*8	*1	*11	*1	*1	*12
2026-1	194	*2	*2	0.4	*4	*5	*6	*1	*8	*1	*11	*1	*12	*12
2026-2	194	2.7	3.5	*3	*4	*5	*1	*1	*8	*1	*11	*1	*1	*1
2162-1	202	9.3	10.5	*3	*4	*5	*6	*7	0.6	*1	*11	*12	*12	*12
2162-2	202	10.0	13.3	*3	*4	*5	*6	*7	0.7	*1	*11	*12	*12	*12
2162-3	202	11.8	11.6	*3	*4	*5	*6	*1	0.7	*1	*11	*1	0.8	0.4
3850-2	214	199.6	42.0	1.5	*4	*5	18.3	*7	5.9	2.9	*11	*12	*12	*12
3850-4	214	*2	*2	*3	*4	*5	18.8	*7	4.1	2.5	*11	*12	*12	*12
9580-4	266	4.3	4.4	3.1	*4	*5	*1	*1	*1	*1	*11	*12	*12	*12
9580-5	266	*2	*2	*3	0.6	*5	1.2	*1	0.6	*1	*11	1.2	*12	*12
9631-1	268	9.9	7.0	*3	*4	*5	1.5	*1	1.9	*1	*11	*12	4.8	3.8
9665-1	271	2.9	5.9	*3	0.7	*5	0.1	*1	*8	*1	*11	2.9	*1	*1
9785-4	274	*2	*2	15.3	*4	*5	11.3	0.4	6.3	1.7	*11	*12	*12	5.0
3292-1	277	*2	*2	*3	*4	*5	*6	*7	2.4	0.5	*11	*12	*12	*12
3292-2	277	14.2	11.8	*3	*4	*5	*6	*7	1.4	*1	*11	*12	6.9	*12
Combined**:		14.8	11.2	3.2	2.3	2.3	4.9	***	3.2	2.4	2.8	8.9	4.7	2.4

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

TABLE E-1

## ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)

Bldg-Blr No.	Survey No.	ECO MATRIX, SAVING TO INVESTMENT RATIOS (SIR)																								
		ECO 16			ECO 17		ECO 18		ECO 19		ECO 20		ECO 21		ECO 24		ECO 25		ECO 28		ECO 29		ECO 30		ECO 33	
		Low Burner	Replc X-air Burner	Replc Boiler	Insul	Fire	M. U.	Tube	Water	Turbs	Ht	Rvy	Auto	Blow	down	Ctrl	Trim	Atomiz	Air	Elim	Vari	Stm	speed	Aux	fans	Oil
9641-1	269	*13	*14	1.7	0.4	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
9641-2	269	*13	1.0	1.1	0.1	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
9669-1	272	*13	3.0	1.6	0.4	3.9	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
9997-1	275	*13	1.2	1.0	0.4	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
9998-1	276	*13	1.2	1.0	0.4	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
14A51-1	281	*13	2.4	1.4	0.5	2.3	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
2165-1	282	*13	1.8	2.4	0.4	6.2	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
5172-1	283	*13	1.1	0.9	0.5	0.8	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
5173-1	284	*13	0.7	0.6	0.4	*1	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
6229-1	285	*13	0.9	0.8	0.8	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
<b>MAIN PLANT BOILERS:</b>																										
1263-1	168	*13	2.9	2.9	0.4	9.3	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
1450-1	171	*13	0.2	1.7	0.3	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
1450-2	171	*13	3.5	1.9	0.3	3.5	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
1452-1	172	*13	*14	0.6	0.3	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
1452-2	172	*13	5.1	1.7	0.5	3.5	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
2001-1	174	*13	3.4	1.5	0.4	0.6	*9	*9	*9	*16	*1	*1	*17	*18	*19	*20	*21									
2025-1	193	*13	0.5	0.3	0.2	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
2025-2	193	*13	0.0	0.1	0.6	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
2026-1	194	*13	*14	*22	0.2	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
2026-2	194	*13	0.5	0.2	0.1	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
2162-1	202	*13	1.1	0.7	0.3	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
2162-2	202	*13	1.4	0.7	0.3	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
2162-3	202	*13	1.3	0.4	0.2	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
3850-2	214	*13	5.7	3.6	*15	*16	2.8	*1	*1	*16	2.8	*1	*17	3.0	*19	0.6	4.6									
3850-4	214	*13	*14	2.9	*15	*16	3.0	*1	*1	*16	3.0	*1	*17	2.3	*19	0.2	*21									
9580-4	266	*13	0.5	0.1	0.0	*16	*1	*1	*1	*16	*1	*1	0.0	*18	*19	*20	*21									
9580-5	266	*13	0.3	0.2	0.3	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
9631-1	268	*13	1.1	0.7	0.6	*16	*1	*1	*1	*16	*1	*1	0.1	*18	*19	*20	*21									
9665-1	271	*13	0.7	0.3	0.5	*16	*1	*1	*1	*16	*1	*1	*17	*18	*19	*20	*21									
9785-4	274	*13	*14	2.3	*15	*16	1.8	0.9	*17	*16	*1	*1	*18	*19	*20	*21										
3292-1	277	1.1	*14	1.3	*15	*16	0.8	0.5	*17	*16	*1	*1	*18	0.4	*20	*21										
3292-2	277	1.0	*14	0.9	*15	*16	*1	*1	*17	*16	*1	*1	*18	*19	*20	*21										
Combined**:		1.4	2.2	2.0	***	1.9	2.6	***	***	***	***	***	2.2	***	***	***	4.6									

Notes: ECO's 2, 3, 22, 23, 26, 27, 31, 32, and 34 did not have boiler specific results.

\*1 indicates that the maintenance cost increase was greater than energy savings.

\*n indicates the ECO was eliminated for reason number 'n' listed after the table.

\*\* The combined SIR includes all boilers with SIR's greater than 1 for that ECO.

\*\*\* None of the analyzed boilers for this ECO had an SIR greater than 1.0.

#### E.5.4 ECO Rejection Criteria

The numbered notes in the ECO matrix refer to reasons for elimination of ECO's from consideration for particular boilers. These reasons are listed below:

- \*1 The calculated energy savings was less than the increase in maintenance costs resulting in a higher annual operating cost.
- \*2 The boiler was already tuned to optimum levels. It should be checked and tuned regularly but was not included in analysis because additional savings could not be found.
- \*3 The boiler is in a single boiler plant or a multiboiler plant where one boiler can always meet load. The ECO only applies to multiple boilers.
- \*4 The boiler load exceeded 80% of the boiler capacity so a smaller boiler could not be installed.
- \*5 Boiler capacity is greater than 1 million Btu/hour or boiler is a steam boiler. Daily shutdown is not appropriate for large or steam boilers due to larger amounts of contraction and expansion or to the higher operating temperatures.
- \*6 Steam boilers without continuous feedwater systems will not operate properly with this ECO without storage tanks and pumps which excessively increases the cost.
- \*7 Oil-fired boilers or plants with less capacity than 1 million Btu's per hour are not appropriate for total heat recovery.
- \*8 The ceiling in the boiler room is less than 20 feet high and stratification cannot develop to allow recovery of heated air.
- \*9 Non-steam boilers do not have blowdown.
- \*10 Boilers without continuous blowdown will not have enough blowdown flow to provide adequate energy savings.
- \*11 Boilers with a draft factor of less than 0.5 were not considered because infiltration for these boilers is acceptable.
- \*12 Boilers already equipped with another form of draft control will not achieve enough savings to justify additional draft controls. Also boilers smaller than 1 million Btu/hour will not benefit from ECO 15.
- \*13 The boiler is too small. Low excess air burners are only generally available for boilers larger than 30 million Btu/hour and for Cleaver Brooks boilers larger than 6.7 million Btu/hour.
- \*14 The existing burner has an excess air rate less than 30% and the burner capacity is less than 20% greater than boiler capacity.

- \*15 Large boilers may suffer structural deformation due to reduced heat loss and are excluded from this ECO.
- \*16 Boilers without fire tubes, burning No. 6 oil, or larger than 10 million Btu/hour are not candidates for installation of turbulators.
- \*17 Boilers smaller than 5.0 million Btu/hour or without modulating burners will have little or no benefit from flue gas trim controls.
- \*18 The boiler does not have steam atomization.
- \*19 The boiler does not have steam auxiliaries.
- \*20 The boiler does not have induced draft fans.
- \*21 Oil tanks are not exposed or boiler does not use No. 6 oil.
- \*22 Replacement not appropriate due to installation of new boiler in plant.

#### E.5.5 ECO's Eliminated

Several ECO's were eliminated from further consideration, or were found to be inappropriate for all the boilers because of specific conditions at Fort Lewis. These are discussed below.

- ECO 2.** Regular cleaning of waterside transfer surfaces is already implemented as an operational procedure at Fort Lewis; hence, ECO 2 was rejected.
- ECO 3.** Steam pressures and water temperatures are already reduced at Fort Lewis. In many cases they are reduced too low, as discussed in Section 6. Further reduction would not be advisable, so the temperature or pressure reduction does not apply at Fort Lewis.
- ECO 22.** A boiler feedwater treatment program is recommended practice, yet it does not provide additional energy savings beyond the savings of ECO 2.
- ECO 23.** Reducing makeup water will save energy; however, reductions can only occur through stopping steam or water leaks. No appreciable leaks were found in the boiler plants and leaks in buildings or distribution piping are not in the study scope; therefore, this ECO was not analyzed for any boilers at Fort Lewis.
- ECO 26.** Outside air reset controls can save energy when boiler temperatures are too high. At Fort Lewis boiler temperatures are typically too low, and it is recommended in Section 6 that they be increased to improve boiler life. Consequently,

**ECO 27.** Desuperheaters or back pressure turbines were not appropriate at Fort Lewis because no plants were observed with pressure reducing valves prior to the distribution system. Consequently, no desuperheaters or backpressure turbines can be recommended. If steam is being supplied at a higher pressure than necessary and the pressure is reduced at the load, there is still potential for savings for this ECO. However, to evaluate the savings and cost would require an analysis of the distribution system and the end use requirements. Since this study is limited to the boiler and boiler auxiliaries, this analysis is outside the scope of work.

**ECO 31.** High efficiency electric motors are recommended when motors are replaced due to failure. However, replacement as an ECO is not cost effective when the full price of a new motor is considered. Consequently, individual boiler plant analysis is not appropriate. An analysis of a full range of motor sizes at different operating hours is included in Section 5.17.

**ECO 32.** Fuel switching was not found to be cost effective for any boilers under current fuel price conditions. This is discussed in detail in Section 5.18.

**ECO 34.** Automatic fuel viscosity control was found to be only marginally better than standard temperature control at a much higher cost. Consequently it was not considered further.

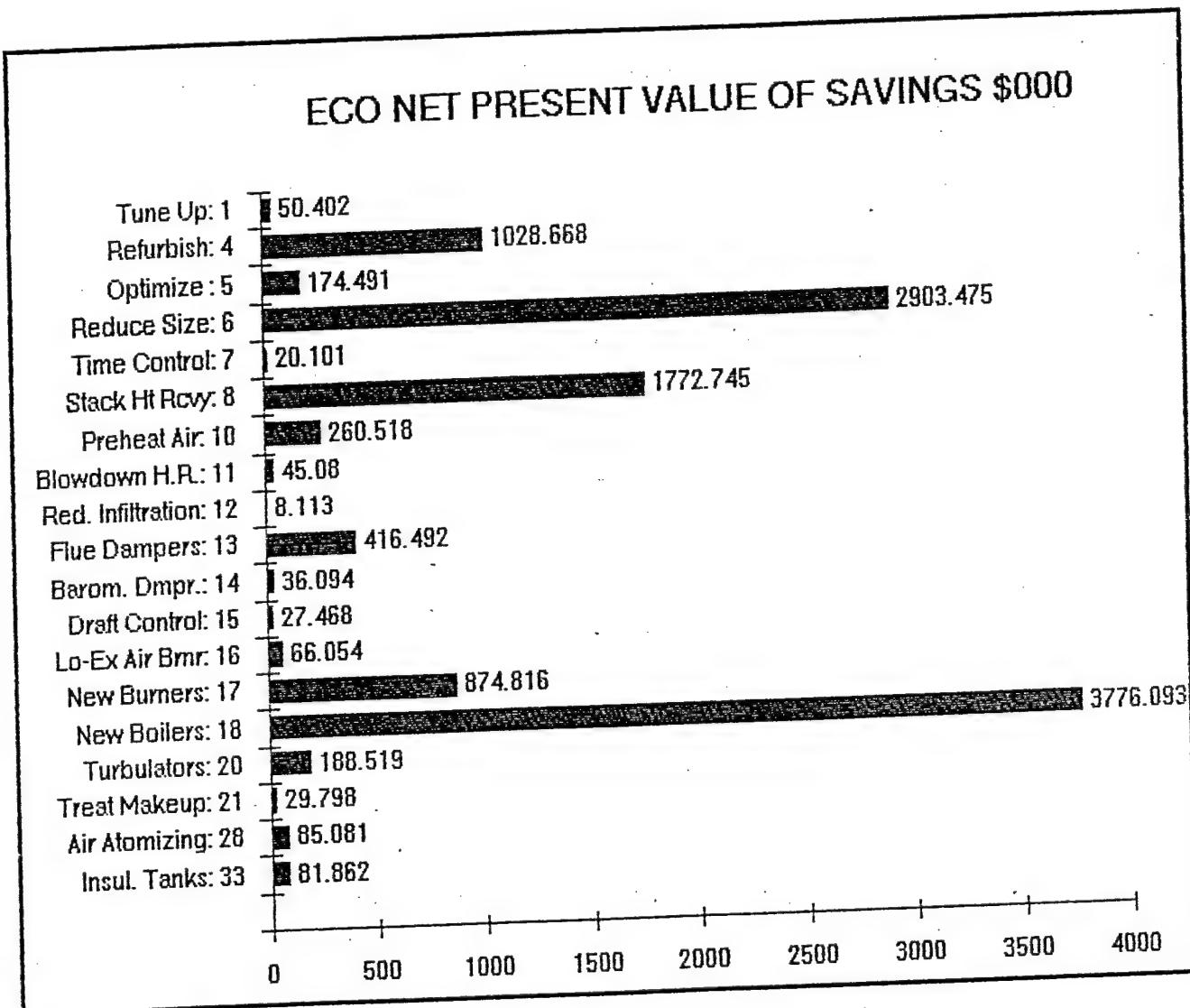
### E.5.6 Life-Cycle Cost Summary

The results of a life-cycle cost analysis for all boilers with an SIR greater than 1.0 are shown in Table E-2. These results are independent for each ECO and do not include interaction, with the exception of ECO 13, which is implemented after ECO 4. Interaction is considered in the packaging discussed in Section E.6. The table is followed by Figure E-3 which shows the net present value for each ECO. The net present value (NPV) is the present value of cost subtracted from the present value (discounted) of savings over the life of the ECO.

TABLE E-2 COMPOSITE SUMMARY OF ECO LIFE CYCLE COST RESULTS

ECO No.	ECO NAME	PRESENT COST (\$000)	PRESENT SAVINGS (\$000)	SAVINGS-TO- INVEST- RATIO SIR	ANNUAL SAVINGS (\$)	SIMPLE PAYBACK PERIOD (years)	NUMBER OF BOILERS	NUMBER WITH SIR>1
1	Tune Up	3.6	54.0	14.8	30314	0.1	123	
4	Refurbish	100.7	1129.4	11.2	145608	0.7	278	
5	Optimize	81.1	255.6	3.2	15267	5.3	3	
6	Reduce Size	2231.0	5134.4	2.3	374849	6.7	193	
7	Time Control	15.3	35.4	2.3	3132	4.9	19	
8	Stack Ht Rcvy	454.7	2227.5	4.9	157554	2.9	33	
10	Preheat Air	119.1	379.6	3.2	22469	5.3	9	
11	Blowdown H.R.	32.8	77.9	2.4	5095	6.4	3	
12	Red. Infiltration	4.5	12.6	2.8	1121	4.0	9	
13	Flue Dampers	52.5	469.0	8.9	29877	1.8	62	
14	Barom. Dmpr.	9.9	46.0	4.7	2966	3.3	23	
15	Draft Control	19.8	47.3	2.4	2991	6.6	12	
16	Lo-Ex Air Brnr	178.4	244.5	1.4	16590	10.8	3	
17	New Burners	723.0	1597.9	2.2	110684	6.5	57	
18	New Boilers	3775.6	7551.7	2.0	469843	8.0	129	
20	Turbulators	56.2	244.7	4.4	30174	1.9	36	
21	Treat Makeup	19.1	48.9	2.6	4009	4.8	3	
28	Air Atomizing	69.2	154.3	2.2	10943	6.3	2	
33	Insul. Tanks	12.6	94.4	7.5	5812	2.2	1	

FIGURE E-3



## E.6

### RECOMMENDED PROJECT PACKAGING

At the Interim Submittal Conference, the maintenance-related ranking of ECO preferences as discussed in Section 8.4 of the Narrative Report was adopted as the initial criteria for ECO selection. This approach favors ECO's which will have a low maintenance cost. ECOs with SIRs greater than 1 in the lowest maintenance category will be considered before ECOs in higher maintenance categories, even if ECOs in higher maintenance categories have higher SIRs. Various package options were discussed at the Interim Conference, and it was determined that four packages will be developed as follows:

- o **Packages 1-3:** ECIP packages which include either ECO 6, 17, or 18 for each cost effective ECO. An ECO is considered cost effective if it meets ECIP requirements of SIR greater than 1.0 and payback less than 10 years. Payback must be less than 7 years for temporary buildings. For each boiler, selection would be as follows: First, select ECO 6, replacement with a smaller boiler. If ECO 6 is not cost effective, select ECO 18, replacement with the same sized boiler. If ECOs 6 and 18 are not cost effective, select ECO 17, burner replacement. These three packages would be divided as follows:
  1. Main Fort Permanent Buildings
  2. Main Fort Temporary Buildings
  3. North Fort Buildings
- o **Package 4:** An QRIP package. For all boilers not included in either packages 1, 2, or 3, combine ECO 4, boiler tuneup and refurbishment, and where cost effective, ECO 13, flue gas dampers.

Packaging results are included in the Project Development brochures for the various projects.

## E.7 ENERGY AND COST SAVINGS

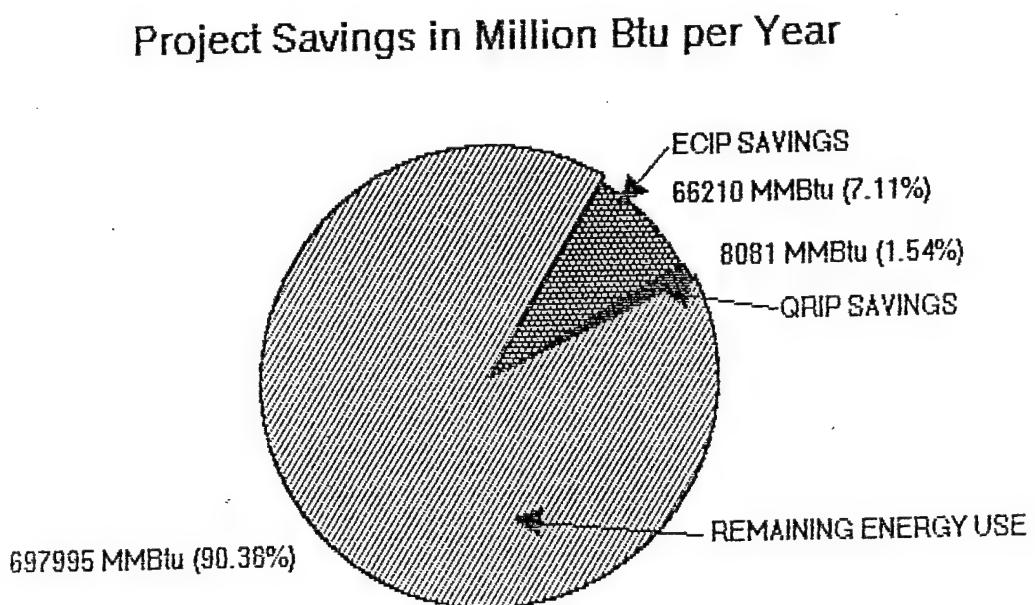
If all four recommended packages are developed, total savings and cost will be as follows:

Package	Annual Savings		
	Million Btu	\$	\$ Cost
1. Main Permanent Boilers	48,631.1	\$318,447	\$1,857,900
2. Main temporary Boilers	5,226.2	46,943	308,700
3. North Fort Boilers	12,353.2	132,814	816,400
4. Remaining Boilers	8,081.1	55,938	75,600
Total	74,291.6	\$554,142	\$3,058,600

Savings and cost data for each ECO is summarized in Table E-4 on Page E-59.

The energy savings as a share of total energy use is shown in the pie chart below. The ECIP savings includes all three ECIP packages for boiler and burner replacement. The QRIP savings is for one package which includes boiler refurbishment and flue gas dampers.

FIGURE E-4



## **E.8 PRIORITY ECO LISTING**

On the following pages, ECO's with a savings-to-investment ratio (SIR) greater than 1 are prioritized in Table E-3. ECO 1, operator tuneup, is not included in Table E-3, because it is recommended for all boilers, regardless of SIR. These are prioritized first by maintenance category and then by SIR. Several ECO's are mutually exclusive or have interdependent savings. In the Packaging Documents, these ECO's have been separated and the best of overlapping ECO's selected. Maintenance categories are as follows:

- A. Replace Equipment, Maintenance Reduction
- B. Refurbish Equipment, Maintenance Reduction
- C. Modify Equipment, No Maintenance Increase
- D. Modify Equipment, Slight Maintenance Increase
- E. Modify Equipment, Substantial Maintenance Increase

TABLE E-3

Analysis Date: October 1988

## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to Invest Ratio	Maintenance Code
6. Reduce Size	7500-1	259	0.0	0.0	1,375.3	0.0	9,325	22.9	2.5	A
6. Reduce Size	7500-2	259	0.0	0.0	1,156.2	0.0	7,875	20.8	2.7	A
17. Replace Burner	7500-1	259	0.0	0.0	658.0	0.0	4,451	10.5	2.4	A
17. Replace Burner	7500-2	259	0.0	0.0	573.5	0.0	3,892	10.5	2.7	A
18. Replace Boiler	9670-1	273	0.0	0.0	804.4	0.0	5,546	18.9	3.4	A
6. Reduce Size	3292-1	277	0.0	6,687.6	0.0	0.0	39,957	154.1	4.5	A
6. Reduce Size	9E1-1	32	0.0	-143.3	290.6	0.0	1,458	5.1	3.5	A
6. Reduce Size	4E1-1	62	0.0	-161.7	307.5	0.0	1,461	5.1	3.5	A
6. Reduce Size	4E23-1	69	0.0	-143.3	290.6	0.0	1,458	5.1	3.5	A
6. Reduce Size	5E1-1	76	0.0	-143.3	290.6	0.0	1,458	5.1	3.5	A
6. Reduce Size	5E2-1	77	0.0	-290.5	596.0	0.0	2,612	9.4	3.6	A
6. Reduce Size	6E1-1	90	0.0	-143.3	290.6	0.0	1,458	5.1	3.5	A
6. Reduce Size	8A27-1	132	0.0	-143.3	290.6	0.0	1,458	5.1	3.5	A
6. Reduce Size	9A8-1	142	0.0	-143.3	290.6	0.0	1,458	5.1	3.5	A
6. Reduce Size	5E3-1	78	0.0	-286.1	585.9	0.0	2,572	9.4	3.7	A
18. Replace Boiler	7500-1	259	0.0	0.0	1,271.4	0.0	8,669	33.9	3.9	A
18. Replace Boiler	2020D-1	187	0.0	0.0	825.1	0.0	5,683	22.5	4.0	A
18. Replace Boiler	2021B-1	189	0.0	0.0	811.8	0.0	5,595	22.5	4.0	A
6. Reduce Size	9550-1	265	0.0	0.0	146.4	0.0	1,347	5.1	3.8	A
6. Reduce Size	2001-1	174	0.0	0.0	742.9	0.0	5,139	21.3	4.2	A
17. Replace Burner	2020D-1	187	0.0	0.0	381.5	0.0	2,621	9.6	3.7	A
6. Reduce Size	1452-2	172	0.0	0.0	995.6	0.0	6,843	29.0	4.3	A
6. Reduce Size	4437-1	237	0.0	-142.9	267.1	0.0	1,305	5.1	3.9	A
6. Reduce Size	3A38-1	114	0.0	0.0	284.4	0.0	2,261	9.4	4.2	A
17. Replace Burner	2021B-1	189	0.0	0.0	368.0	0.0	2,531	9.6	3.8	A
6. Reduce Size	5E24-1	84	0.0	-143.3	263.3	0.0	1,277	5.1	4.0	A
6. Reduce Size	11B29-1	149	0.0	0.0	276.2	0.0	2,206	9.4	4.3	A
6. Reduce Size	1401-1	169	0.0	4,198.1	0.0	0.0	25,294	138.4	4.7	A
6. Reduce Size	3C30-1	150	0.0	0.0	268.9	0.0	2,158	9.4	4.4	A
6. Reduce Size	11D47-1	156	0.0	0.0	269.4	0.0	2,161	9.4	4.4	A
6. Reduce Size	2270-1	208	0.0	0.0	266.7	0.0	2,144	9.4	4.4	A
6. Reduce Size	3725-1	213	0.0	0.0	266.7	0.0	2,144	9.4	4.4	A
6. Reduce Size	6229-1	285	0.0	0.0	269.0	0.0	2,159	9.4	3.6	A

TABLE E-3

Analysis Date: October 1988

## PRIORITIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year	Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
6. Reduce Size	1450-2	171	0.0	795.8	0.0	5,520	25.1	4.6	3.6 A
18. Replace Boiler	3850-2	214	0.0	0.0	9,459.1	59,686	262.6	4.4	3.6 A
6. Reduce Size	2A15-1	109	0.0	0.0	251.7	0.0	2,044	9.4	3.4 A
18. Replace Boiler	7500-2	259	0.0	0.0	1,013.6	0.0	6,962	34.1	4.9 3.4 A
6. Reduce Size	3E90-1	61	0.0	0.0	112.6	0.0	1,123	5.1	4.6 3.2 A
6. Reduce Size	5209-1	252	0.0	0.0	223.8	0.0	1,860	9.4	5.1 3.1 A
18. Replace Boiler	2020A-1	184	0.0	0.0	634.0	0.0	4,449	24.5	5.5 3.0 A
18. Replace Boiler	2020C-1	186	0.0	0.0	634.0	0.0	4,449	24.5	5.5 3.0 A
18. Replace Boiler	2021A-1	188	0.0	0.0	578.1	0.0	4,048	22.4	5.6 3.0 A
18. Replace Boiler	2021C-1	190	0.0	0.0	578.1	0.0	4,048	22.4	5.6 3.0 A
18. Replace Boiler	2021D-1	191	0.0	0.0	578.1	0.0	4,048	22.4	5.6 3.0 A
18. Replace Boiler	2054-1	197	0.0	0.0	691.4	0.0	4,829	26.6	5.5 3.0 A
18. Replace Boiler	1263-1	168	0.0	0.0	1,233.0	0.0	8,540	48.5	5.7 2.9 A
18. Replace Boiler	3850-4	214	0.0	0.0	0.0	8,284.8	52,347	287.8	5.5 2.9 A
18. Replace Boiler	1036-1	163	0.0	0.0	96.6	0.0	1,017	5.1	5.0 2.8 A
18. Replace Boiler	1037-1	164	0.0	0.0	96.6	0.0	1,017	5.1	5.0 2.8 A
18. Replace Boiler	9620-1	267	0.0	0.0	663.6	0.0	4,645	27.6	6.0 2.8 A
6. Reduce Size	5182-1	251	0.0	0.0	188.6	0.0	1,627	9.4	5.8 2.7 A
6. Reduce Size	4320-1	229	0.0	0.0	666.6	0.0	4,665	29.0	6.3 2.6 A
6. Reduce Size	4127-1	221	0.0	0.0	169.9	0.0	1,503	9.4	6.3 2.5 A
6. Reduce Size	3E12-1	51	0.0	-286.1	430.8	0.0	1,545	9.4	6.1 2.4 A
6. Reduce Size	4E24-1	70	0.0	-286.1	432.5	0.0	1,556	9.4	6.1 2.4 A
6. Reduce Size	2110-1	201	0.0	485.3	0.0	0.0	3,079	21.5	7.0 2.4 A
18. Replace Boiler	2165-1	282	0.0	0.0	563.3	0.0	3,981	26.6	6.7 2.4 A
6. Reduce Size	5E23-1	83	0.0	-290.5	426.6	0.0	1,491	9.4	6.3 2.3 A
6. Reduce Size	9A1-1	137	0.0	-290.5	426.6	0.0	1,491	9.4	6.3 2.3 A
6. Reduce Size	2068-1	198	0.0	0.0	426.9	0.0	3,047	21.9	7.2 2.3 A
6. Reduce Size	14A51-1	281	0.0	0.0	485.1	0.0	3,463	24.9	7.2 2.3 A
18. Replace Boiler	2015B-1	182	0.0	0.0	445.9	0.0	3,173	22.4	7.1 2.3 A
18. Replace Boiler	9785-4	274	0.0	5,963.4	0.0	0.0	35,691	268.5	7.6 2.3 A
6. Reduce Size	2150-1	204	0.0	375.5	0.0	0.0	2,433	18.9	7.8 2.2 A
6. Reduce Size	3E48-1	57	0.0	0.0	149.8	0.0	1,370	9.4	6.9 2.2 A
6. Reduce Size	4292-1	228	0.0	0.0	149.6	0.0	1,368	9.4	6.9 2.2 A

TABLE E-3

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## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey No.	Million Btu's per Year	Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to Invest Ratio	Maintenance Code
6. Reduce Size	7E2-1	2	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E3-1	3	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E4-1	4	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E5-1	5	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E6-1	6	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E7-1	7	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E24-1	9	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E25-1	10	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E26-1	11	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E27-1	12	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E28-1	13	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	7E29-1	14	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E2-1	17	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E3-1	18	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E4-1	19	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E5-1	20	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E6-1	21	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E7-1	22	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E24-1	25	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E25-1	26	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E26-1	27	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E27-1	28	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E28-1	29	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	8E29-1	30	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	9E3-1	34	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	9E4-1	35	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	9E5-1	36	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	9E6-1	37	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	9E7-1	38	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	9E24-1	41	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	9E25-1	42	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	9E26-1	43	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A
6. Reduce Size	9E27-1	44	0.0	-286.1	403.4	0.0	1,363	9.4	6.9 2.1 A

TABLE E-3

Analysis Date: October 1988

## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Number	Survey No.	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
				Elec	Nat Gas	2 011	6 011				
6.	Reduce Size	9E28-1	45	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	9E29-1	46	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	4E6-1	67	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	4E7-1	68	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	4E28-1	74	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	4E29-1	75	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	5E4-1	79	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	5E5-1	80	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	5E6-1	81	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	5E7-1	82	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	5E25-1	85	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	5E26-1	86	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	5E27-1	87	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	5E28-1	88	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	5E29-1	89	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E2-1	91	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E3-1	92	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E4-1	93	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E5-1	94	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E6-1	95	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E23-1	97	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E24-1	98	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E25-1	99	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E26-1	100	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E27-1	101	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E28-1	102	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6E29-1	103	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	1E15-1	104	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	6A7-1	119	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	4433-1	233	0.0	-286.1	403.9	0.0	1,367	9.4	6.9	2.1
6.	Reduce Size	4434-1	234	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	4435-1	235	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1
6.	Reduce Size	4446-1	240	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1

TABLE E-3

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## PRIORITIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Number	Survey No.	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
				Elec	Nat Gas	2 oil					
6. Reduce Size	4447-1	241	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1	A
6. Reduce Size	4448-1	242	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1	A
6. Reduce Size	4449-1	243	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1	A
6. Reduce Size	4450-1	244	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1	A
6. Reduce Size	4451-1	245	0.0	-286.1	403.4	0.0	1,363	9.4	6.9	2.1	A
6. Reduce Size	6D35-1	152	0.0	0.0	344.6	0.0	2,502	19.2	7.7	2.1	A
6. Reduce Size	4274-1	225	0.0	0.0	139.0	0.0	1,298	9.4	7.3	2.1	A
18. Replace Boiler	2008B-2	279	0.0	0.0	338.5	0.0	2,462	18.9	7.7	2.1	A
18. Replace Boiler	2166-1	206	0.0	0.0	726.6	0.0	5,062	38.6	7.7	2.1	A
18. Replace Boiler	2202-1	207	0.0	0.0	613.0	0.0	4,310	33.4	7.8	2.1	A
6. Reduce Size	3A2-1	110	0.0	0.0	312.6	0.0	2,290	18.9	8.3	2.0	A
17. Replace Burner	2006-1	177	0.0	0.0	203.2	0.0	1,440	10.4	7.3	2.0	A
17. Replace Burner	2020A-1	184	0.0	0.0	199.4	0.0	1,415	10.3	7.3	2.0	A
17. Replace Burner	2020C-1	186	0.0	0.0	200.4	0.0	1,422	10.3	7.3	2.0	A
18. Replace Boiler	2110-1	201	0.0	453.5	0.0	0.0	2,923	24.8	8.5	2.0	A
18. Replace Boiler	2140-1	203	0.0	0.0	458.1	0.0	3,285	26.7	8.2	2.0	A
6. Reduce Size	7E1-1	1	0.0	-143.3	197.5	0.0	0.0	841	5.1	6.1	1.9
6. Reduce Size	7E23-1	8	0.0	-143.3	197.5	0.0	0.0	841	5.1	6.1	1.9
6. Reduce Size	7E30-1	15	0.0	-143.3	197.5	0.0	0.0	841	5.1	6.1	1.9
6. Reduce Size	8E1-1	16	0.0	-143.3	197.5	0.0	0.0	841	5.1	6.1	1.9
6. Reduce Size	8E23-1	24	0.0	-143.3	197.5	0.0	0.0	841	5.1	6.1	1.9
6. Reduce Size	8E30-1	31	0.0	-143.3	197.5	0.0	0.0	841	5.1	6.1	1.9
6. Reduce Size	9E2-1	33	0.0	-286.1	384.4	0.0	0.0	1,238	9.4	7.6	1.9
6. Reduce Size	9E8-1	39	0.0	-143.3	197.5	0.0	0.0	841	5.1	6.1	1.9
6. Reduce Size	9E23-1	40	0.0	-143.3	197.5	0.0	0.0	841	5.1	6.1	1.9
6. Reduce Size	2E1-1	49	0.0	-286.1	384.4	0.0	0.0	1,238	9.4	7.6	1.9
6. Reduce Size	3E6-1	50	0.0	-286.1	384.4	0.0	0.0	1,238	9.4	7.6	1.9
6. Reduce Size	3E43-1	55	0.0	-286.1	384.4	0.0	0.0	1,238	9.4	7.6	1.9
6. Reduce Size	3E44-1	56	0.0	-286.1	384.4	0.0	0.0	1,238	9.4	7.6	1.9
6. Reduce Size	3E54-1	58	0.0	-286.1	384.4	0.0	0.0	1,238	9.4	7.6	1.9
6. Reduce Size	3E55-1	59	0.0	-286.1	384.4	0.0	0.0	1,238	9.4	7.6	1.9
6. Reduce Size	3E56-1	60	0.0	-286.1	384.4	0.0	0.0	1,238	9.4	7.6	1.9
6. Reduce Size	4E2-1	63	0.0	-286.1	384.4	0.0	0.0	1,238	9.4	7.6	1.9

TABLE E-3

Analysis Date: October 1988

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year			Savings			Annual Construction Cost (\$000)	Annual Dollar Savings	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
			Elec	Nat Gas	2 oil	6 oil							
6. Reduce Size	4E3-1	64	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	4E4-1	65	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	4E5-1	66	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	4E25-1	71	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	4E26-1	72	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	4E27-1	73	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	1E40-1	106	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	1E47-1	107	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	1E55-1	108	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A2-1	115	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A3-1	116	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A4-1	117	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A6-1	118	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A32-1	120	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A33-1	121	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A36-1	122	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A37-1	123	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A40-1	126	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	6A41-1	127	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	8A2-1	128	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	8A3-1	129	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	8A6-1	130	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	8A7-1	131	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	8A28-1	133	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	8A29-1	134	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	8A32-1	135	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	8A33-1	136	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	9A2-1	138	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	9A3-1	139	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	9A6-1	140	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	9A7-1	141	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	9A28-1	143	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A
6. Reduce Size	9A29-1	144	0.0	-286.1	384.4	0.0	1,238	9.4	7.6	7.6	1.9	A	A

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Analysis Date: October 1988

## PRIORITIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Saved-to-Invest Ratio	Maintenance Code
		No.	Elec	Nat Gas	2 oil	6 oil		
6.	Reduce Size	9A32-1	145	0.0	-286.1	384.4	9.4	7.6
6.	Reduce Size	9A33-1	146	0.0	-286.1	384.4	9.4	7.6
6.	Reduce Size	4436-1	236	0.0	-142.9	197.2	0.0	6.1
6.	Reduce Size	4444-1	238	0.0	-142.9	197.2	0.0	6.1
6.	Reduce Size	4445-1	239	0.0	-142.9	197.2	0.0	6.1
17.	Replace Burner	2021A-1	188	0.0	0.0	181.6	0.0	1.9
17.	Replace Burner	2021C-1	190	0.0	0.0	181.6	0.0	1.9
17.	Replace Burner	2021D-1	191	0.0	0.0	181.6	0.0	1.9
17.	Replace Burner	4320-1	229	0.0	0.0	226.7	0.0	1.627
18.	Replace Boiler	1450-2	171	0.0	0.0	720.6	0.0	5,085
6.	Reduce Size	2400-1	210	0.0	339.9	0.0	2,223	21.1
6.	Reduce Size	9500-1	261	0.0	0.0	721.4	0.0	5,091
18.	Replace Boiler	9E2-1	33	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	2E1-1	49	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	3E6-1	50	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	3E43-1	55	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	3E44-1	56	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	3E54-1	58	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	3E55-1	59	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	3E56-1	60	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	4E2-1	63	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	4E3-1	64	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	4E4-1	65	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	4E5-1	66	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	4E25-1	71	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	4E26-1	72	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	4E27-1	73	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	1E40-1	106	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	1E47-1	107	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	1E55-1	108	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	6A2-1	115	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	6A3-1	116	0.0	-291.6	384.4	0.0	1,205
18.	Replace Boiler	6A4-1	117	0.0	-291.6	384.4	0.0	1,205

TABLE E-3

Analysis Date: October 1988

## PRIORITY ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Number	Survey No.	Million Btu's per Year			Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
				Elec	Nat Gas	2 oil	6 oil							
18.	Replace Boiler	6A6-1	118	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	6A32-1	120	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	6A33-1	121	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	6A36-1	122	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	6A37-1	123	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	6A40-1	126	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	6A41-1	127	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	8A2-1	128	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	8A3-1	129	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	8A6-1	130	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	8A7-1	131	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	8A28-1	133	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	8A29-1	134	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	8A32-1	135	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	8A33-1	136	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	9A2-1	138	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	9A3-1	139	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	9A6-1	140	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	9A7-1	141	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	9A28-1	143	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	9A29-1	144	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	9A32-1	145	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	9A33-1	146	0.0	-291.6	384.4	0.0	1,205	9.4	7.9	1.8	A		
18.	Replace Boiler	2019A-1	183	0.0	0.0	343.4	0.0	2,494	22.4	9.0	1.8	A		
18.	Replace Boiler	2019B-2	183	0.0	0.0	343.4	0.0	2,494	22.4	9.0	1.8	A		
18.	Replace Boiler	3E53-1	280	0.0	0.0	113.6	0.0	1,130	9.4	8.4	1.8	A		
18.	Replace Boiler	IJ8-1	48	0.0	0.0	376.6	0.0	2,745	25.1	9.2	1.8	A		
6.	Reduce Size	9E30-1	47	0.0	-149.4	198.6	0.0	813	5.1	6.3	1.7	A		
6.	Reduce Size	3E15-1	52	0.0	-286.1	374.1	0.0	1,169	9.4	8.1	1.7	A		
6.	Reduce Size	3E16-1	53	0.0	-286.1	374.1	0.0	1,169	9.4	8.1	1.7	A		
17.	Replace Burner	2110-1	201	0.0	180.9	0.0	0.0	1,161	10.3	8.9	1.7	A		
17.	Replace Burner	2140-1	203	0.0	172.9	0.0	0.0	1,240	10.3	8.4	1.7	A		
17.	Replace Burner	IJ8-1	48	0.0	171.2	0.0	0.0	1,228	10.3	8.4	1.7	A		

TABLE E-3

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## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to Invest Ratio	Maintenance Code
		No.	Elec	Nat Gas	Oil					
18.	Replace Boiler	3E15-1	52	0.0	-290.2	374.1	0.0	1,145	9.4	8.3
18.	Replace Boiler	3E16-1	53	0.0	-290.2	374.1	0.0	1,145	9.4	8.3
18.	Replace Boiler	2012-1	178	0.0	0.0	504.6	0.0	3,592	34.2	9.6
18.	Replace Boiler	2013-1	179	0.0	0.0	504.6	0.0	3,592	34.2	9.6
18.	Replace Boiler	4290-1	226	0.0	0.0	353.1	0.0	2,590	25.1	9.8
18.	Replace Boiler	4290-2	226	0.0	0.0	353.1	0.0	2,590	25.1	9.8
18.	Replace Boiler	4548-1	249	0.0	-128.3	176.0	0.0	787	5.1	6.5
18.	Replace Boiler	2007A-1	278	0.0	0.0	268.2	0.0	1,996	19.4	9.8
18.	Replace Boiler	2007B-2	278	0.0	0.0	268.2	0.0	1,996	19.4	9.8
18.	Replace Boiler	2007C-3	278	0.0	0.0	268.2	0.0	1,996	19.4	9.8
18.	Replace Boiler	2008C-3	279	0.0	0.0	268.2	0.0	1,996	19.4	9.8
18.	Replace Boiler	9641-1	269	0.0	0.0	613.7	0.0	4,378	42.8	9.8
18.	Replace Boiler	1450-1	171	0.0	707.6	0.0	0.0	4,483	44.7	10.0
18.	Replace Boiler	1452-2	172	0.0	0.0	799.5	0.0	5,671	54.2	9.6
6.	Reduce Size	2493-1	212	0.0	0.0	278.5	0.0	2,065	20.8	10.1
6.	Reduce Size	4218-1	223	0.0	0.0	103.4	0.0	1,063	9.4	8.9
17.	Replace Burner	2015B-1	182	0.0	0.0	147.2	0.0	1,069	9.6	9.0
18.	Replace Boiler	8E8-1	23	0.0	-145.2	188.8	0.0	773	5.1	6.6
18.	Replace Boiler	4431-1	231	0.0	-287.6	366.9	0.0	1,113	9.4	8.5
18.	Replace Boiler	9669-1	272	0.0	0.0	551.6	0.0	3,904	39.9	10.3
6.	Reduce Size	3A3-1	111	0.0	0.0	240.3	0.0	1,812	19.2	10.7
6.	Reduce Size	5227-1	253	0.0	0.0	234.0	0.0	1,770	18.9	10.7
17.	Replace Burner	2013-1	179	0.0	0.0	152.1	0.0	1,102	10.5	9.6
18.	Replace Boiler	5E2-1	77	0.0	-363.1	596.0	0.0	2,028	21.5	10.7
18.	Replace Boiler	6A38-1	124	0.0	-143.8	185.3	0.0	758	5.1	6.8
18.	Replace Boiler	6A39-1	125	0.0	-143.8	185.3	0.0	758	5.1	6.8
18.	Replace Boiler	4320-1	229	0.0	0.0	565.1	0.0	4,056	44.3	11.0
18.	Replace Boiler	2001-1	174	0.0	0.0	583.8	0.0	4,180	45.0	10.8
6.	Reduce Size	2014-1	180	0.0	0.0	217.0	0.0	1,658	18.9	11.5
6.	Reduce Size	3A35-1	113	0.0	0.0	223.3	0.0	1,699	20.0	11.8
6.	Reduce Size	13C53-1	151	0.0	0.0	220.2	0.0	1,679	18.9	11.3
6.	Reduce Size	9997-1	275	0.0	0.0	265.8	0.0	1,981	23.2	11.8
6.	Reduce Size	9998-1	276	0.0	0.0	265.8	0.0	1,981	23.2	11.8

TABLE E-3

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ECO No.	ECO Name	Building-Boiler Number	Survey No.	Million Btu's per Year			Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
				Elec	Nat Gas	2 oil	6 oil							
17. Replace Burner	2012-1	178	0.0	0.0	144.6	0.0	1,052	10.5	10.0	1.4	A			
17. Replace Burner	1163-1	166	0.0	0.0	140.6	0.0	1,026	10.3	10.1	1.4	A			
17. Replace Burner	1163-2	166	0.0	0.0	140.6	0.0	1,026	10.3	10.1	1.4	A			
18. Replace Boiler	5E3-1	78	0.0	-363.7	585.9	0.0	1,957	21.5	11.1	1.4	A			
18. Replace Boiler	1163-1	166	0.0	0.0	293.8	0.0	2,197	25.2	11.5	1.4	A			
18. Replace Boiler	1163-2	166	0.0	0.0	293.8	0.0	2,197	25.2	11.5	1.4	A			
18. Replace Boiler	1401-1	169	0.0	3,557.3	0.0	0.0	21,519	264.7	12.4	1.4	A			
18. Replace Boiler	9500-1	261	0.0	0.0	633.0	0.0	4,568	51.2	11.3	1.4	A			
18. Replace Boiler	14A51-1	281	0.0	0.0	427.1	0.0	3,079	35.3	11.5	1.4	A			
6. Reduce Size	10B8-1	148	0.0	0.0	205.8	0.0	1,583	19.3	12.3	1.3	A			
6. Reduce Size	4336-1	230	0.0	0.0	201.1	0.0	1,552	18.9	12.3	1.3	A			
6. Reduce Size	5172-1	283	0.0	0.0	226.3	0.0	1,719	21.1	12.4	1.3	A			
6. Reduce Size	1452-1	172	0.0	0.0	303.0	0.0	2,258	29.0	12.9	1.3	A			
17. Replace Burner	2019A-1	183	0.0	0.0	120.6	0.0	893	9.6	10.8	1.3	A			
17. Replace Burner	2019B-2	183	0.0	0.0	123.1	0.0	910	9.6	10.6	1.3	A			
17. Replace Burner	4290-1	226	0.0	0.0	127.1	0.0	936	10.3	11.1	1.3	A			
17. Replace Burner	4290-2	226	0.0	0.0	127.1	0.0	936	10.3	11.1	1.3	A			
17. Replace Burner	14A26-1	147	0.0	0.0	140.7	0.0	1,057	11.7	11.1	1.3	A			
17. Replace Burner	1401-1	169	0.0	0.0	795.2	0.0	4,873	54.9	11.3	1.3	A			
18. Replace Boiler	9D30-1	153	0.0	0.0	82.0	0.0	921	9.4	10.3	1.3	A			
18. Replace Boiler	9D38-1	154	0.0	0.0	82.0	0.0	921	9.4	10.3	1.3	A			
18. Replace Boiler	2006-1	177	0.0	0.0	296.6	0.0	2,215	27.6	12.5	1.3	A			
18. Replace Boiler	3292-1	277	0.0	4,605.0	0.0	0.0	27,690	352.9	12.8	1.3	A			
6. Reduce Size	14A26-1	147	0.0	0.0	364.8	0.0	2,667	35.4	13.4	1.2	A			
6. Reduce Size	2004-1	176	0.0	0.0	183.1	0.0	1,433	19.6	13.8	1.2	A			
17. Replace Burner	2020B-1	185	0.0	0.0	123.4	0.0	912	10.4	11.5	1.2	A			
18. Replace Boiler	2008A-1	279	0.0	0.0	181.7	0.0	1,424	18.9	13.4	1.2	A			
18. Replace Boiler	3A3-1	111	0.0	0.0	214.2	0.0	1,639	21.1	13.0	1.2	A			
6. Reduce Size	2103-1	199	0.0	186.8	0.0	0.0	1,321	18.9	14.4	1.1	A			
6. Reduce Size	9504-1	263	0.0	0.0	173.2	0.0	1,368	18.9	13.9	1.1	A			
17. Replace Burner	2400-1	210	0.0	117.0	0.0	0.0	784	10.5	13.5	1.1	A			
17. Replace Burner	2007A-1	278	0.0	92.0	0.0	0.0	704	8.7	12.4	1.1	A			
17. Replace Burner	2007B-2	278	0.0	90.5	0.0	0.0	694	8.7	12.6	1.1	A			

TABLE E-3

Analysis Date: October 1988

## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	No.	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
				Elec	Nat Gas	2 oil	6 oil				
17.	Replace Burner	2007C-3	278	0.0	0.0	88.7	0.0	682	8.7	12.8	A
17.	Replace Burner	2008C-3	279	0.0	0.0	88.7	0.0	682	8.7	12.8	A
17.	Replace Burner	2A15-1	109	0.0	0.0	91.1	0.0	698	9.1	13.1	A
17.	Replace Burner	3A2-1	110	0.0	0.0	103.4	0.0	780	10.5	13.5	A
17.	Replace Burner	13C53-1	151	0.0	0.0	91.2	0.0	699	9.0	13.0	A
18.	Replace Boiler	1010-1	157	0.0	0.0	185.1	0.0	1,446	20.7	14.4	A
18.	Replace Boiler	1017-1	159	0.0	0.0	68.2	0.0	829	9.4	11.4	A
18.	Replace Boiler	2014-1	180	0.0	0.0	184.1	0.0	1,440	20.7	14.5	A
18.	Replace Boiler	2015A-1	181	0.0	0.0	283.0	0.0	2,125	32.3	15.3	A
18.	Replace Boiler	2020B-1	185	0.0	0.0	279.2	0.0	2,100	29.3	14.0	A
18.	Replace Boiler	2103-1	199	0.0	0.0	178.0	0.0	1,269	18.9	15.0	A
18.	Replace Boiler	2150-1	204	0.0	0.0	265.0	0.0	1,813	26.7	14.8	A
18.	Replace Boiler	4174-1	222	0.0	0.0	215.8	0.0	1,650	23.6	14.4	A
18.	Replace Boiler	2A15-1	109	0.0	0.0	186.7	0.0	1,457	20.6	14.2	A
18.	Replace Boiler	13C53-1	151	0.0	0.0	173.8	0.0	1,372	20.2	14.8	A
18.	Replace Boiler	9641-2	269	0.0	0.0	310.8	0.0	2,309	34.6	15.1	A
17.	Replace Burner	2150-1	204	0.0	0.0	108.5	0.0	0.0	734	10.3	A
17.	Replace Burner	9670-1	273	0.0	0.0	82.2	0.0	639	8.6	13.5	A
17.	Replace Burner	3A35-1	113	0.0	0.0	98.7	0.0	748	10.3	13.9	A
17.	Replace Burner	1161-1	165	0.0	0.0	100.7	0.0	762	10.5	13.9	A
18.	Replace Boiler	1033-1	161	0.0	0.0	175.2	0.0	1,381	21.2	15.5	A
18.	Replace Boiler	1034-1	162	0.0	0.0	150.0	0.0	1,214	18.9	15.7	A
18.	Replace Boiler	2003-1	175	0.0	0.0	149.1	0.0	1,208	18.9	15.7	A
18.	Replace Boiler	2109-1	200	0.0	0.0	149.3	0.0	1,209	18.9	15.7	A
18.	Replace Boiler	4071-1	217	0.0	0.0	208.3	0.0	1,631	25.8	15.9	A
18.	Replace Boiler	6133-1	256	0.0	0.0	66.7	0.0	820	9.4	11.5	A
18.	Replace Boiler	6165-1	257	0.0	0.0	66.3	0.0	817	9.4	11.6	A
18.	Replace Boiler	6203-1	258	0.0	0.0	66.7	0.0	820	9.4	11.5	A
18.	Replace Boiler	9997-1	275	0.0	0.0	236.2	0.0	1,816	27.7	15.4	A
18.	Replace Boiler	9998-1	276	0.0	0.0	236.2	0.0	1,816	27.7	15.4	A
4.	Refurbish Boiler	7500-2	259	0.0	0.0	518.1	0.0	3,525	0.1	92.1	B
4.	Refurbish Boiler	7500-1	259	0.0	0.0	570.6	0.0	3,872	0.1	75.9	B
4.	Refurbish Boiler	2166-1	206	0.0	0.0	376.4	0.0	2,587	0.1	50.6	B

TABLE E-3

Analysis Date: October 1988

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year Savings			Annual Dollar Savings (\$000)	Construction Cost (\$000)	Simple Payback years	Save-to Invest Ratio	Maintenance Code
			Elec	Nat Gas	Oil					
4. Refurbish Boiler	9500-1	261	0.0	0.0	435.9	0.0	2,981	0.1	0.2	46.7 B
4. Refurbish Boiler	1452-2	172	0.0	0.0	342.4	0.0	2,362	0.1	0.2	46.2 B
4. Refurbish Boiler	2001-1	174	0.0	0.0	251.4	0.0	1,759	0.1	0.2	45.8 B
4. Refurbish Boiler	3850-2	214	0.0	0.0	0.0	2,131.6	13,449	0.1	0.2	42.0 B
4. Refurbish Boiler	9669-1	272	0.0	0.0	280.6	0.0	1,953	0.1	0.2	38.2 B
4. Refurbish Boiler	2020D-1	187	0.0	0.0	352.3	0.0	2,427	0.1	0.2	38.0 B
4. Refurbish Boiler	2021B-1	189	0.0	0.0	346.7	0.0	2,390	0.1	0.2	37.4 B
4. Refurbish Boiler	2054-1	197	0.0	0.0	312.8	0.0	2,166	0.1	0.2	33.9 B
4. Refurbish Boiler	1450-2	171	0.0	0.0	228.3	0.0	1,606	0.1	0.3	31.4 B
4. Refurbish Boiler	1263-1	168	0.0	0.0	328.2	0.0	2,268	0.1	0.3	29.6 B
4. Refurbish Boiler	14A51-1	281	0.0	0.0	203.6	0.0	1,443	0.1	0.3	28.1 B
4. Refurbish Boiler	4320-1	229	0.0	0.0	198.1	0.0	1,406	0.1	0.3	27.4 B
4. Refurbish Boiler	1401-1	169	0.0	0.0	659.0	0.0	3,977	0.1	0.3	26.6 B
4. Refurbish Boiler	2202-1	207	0.0	0.0	229.0	0.0	1,611	0.1	0.3	25.2 B
4. Refurbish Boiler	2110-1	201	0.0	0.0	144.5	0.0	946	0.1	0.3	25.1 B
4. Refurbish Boiler	2020A-1	184	0.0	0.0	191.6	0.0	1,363	0.1	0.4	21.3 B
4. Refurbish Boiler	2020C-1	186	0.0	0.0	191.6	0.0	1,363	0.1	0.4	21.3 B
4. Refurbish Boiler	2015B-1	182	0.0	0.0	142.1	0.0	1,036	0.1	0.4	20.1 B
4. Refurbish Boiler	2165-1	282	0.0	0.0	179.0	0.0	1,280	0.1	0.4	20.0 B
4. Refurbish Boiler	2021A-1	188	0.0	0.0	175.5	0.0	1,257	0.1	0.4	19.6 B
4. Refurbish Boiler	2021C-1	190	0.0	0.0	175.5	0.0	1,257	0.1	0.4	19.6 B
4. Refurbish Boiler	2021D-1	191	0.0	0.0	175.5	0.0	1,257	0.1	0.4	19.6 B
4. Refurbish Boiler	2012-1	178	0.0	0.0	132.5	0.0	972	0.1	0.4	18.9 B
4. Refurbish Boiler	2013-1	179	0.0	0.0	132.5	0.0	972	0.1	0.4	18.9 B
4. Refurbish Boiler	IJ8-1	48	0.0	0.0	129.5	0.0	952	0.1	0.4	18.5 B
4. Refurbish Boiler	2400-1	210	0.0	0.0	100.7	0.0	688	0.1	0.4	18.1 B
4. Refurbish Boiler	2140-1	203	0.0	0.0	125.7	0.0	927	0.1	0.4	18.0 B
4. Refurbish Boiler	2150-1	204	0.0	0.0	98.8	0.0	677	0.1	0.4	17.8 B
4. Refurbish Boiler	3A2-1	110	0.0	0.0	88.0	0.0	678	0.1	0.4	17.5 B
4. Refurbish Boiler	4290-1	226	0.0	0.0	118.0	0.0	876	0.1	0.5	17.0 B
4. Refurbish Boiler	4290-2	226	0.0	0.0	118.0	0.0	876	0.1	0.5	17.0 B
4. Refurbish Boiler	2A15-1	109	0.0	0.0	85.0	0.0	658	0.1	0.5	16.9 B
4. Refurbish Boiler	3A35-1	113	0.0	0.0	81.5	0.0	635	0.1	0.5	16.3 B

TABLE E-3

Analysis Date: October 1988

## PRIORITIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey No.	Million Btu's per Year	Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
4.	Refurbish Boiler	13C53-1	151	0.0	80.5	0.0	628	0.1	16.2 B
4.	Refurbish Boiler	2019A-1	183	0.0	110.2	0.0	825	0.1	16.0 B
4.	Refurbish Boiler	2019B-2	183	0.0	110.2	0.0	825	0.1	16.0 B
4.	Refurbish Boiler	5172-1	283	0.0	78.5	0.0	615	0.1	15.8 B
4.	Refurbish Boiler	1163-1	166	0.0	106.1	0.0	797	0.1	15.5 B
4.	Refurbish Boiler	1163-2	166	0.0	106.1	0.0	797	0.1	15.5 B
4.	Refurbish Boiler	3A38-1	114	0.0	75.8	0.0	597	0.1	15.4 B
4.	Refurbish Boiler	14A26-1	147	0.0	99.7	0.0	755	0.1	14.6 B
4.	Refurbish Boiler	2006-1	177	0.0	175.3	0.0	1,255	0.1	14.0 B
4.	Refurbish Boiler	6D35-1	152	0.0	64.0	0.0	519	0.1	13.3 B
4.	Refurbish Boiler	2493-1	212	0.0	63.9	0.0	518	0.1	13.3 B
4.	Refurbish Boiler	2162-2	202	0.0	141.2	0.0	1,030	0.1	13.3 B
4.	Refurbish Boiler	5227-1	253	0.0	63.1	0.0	513	0.1	13.2 B
4.	Refurbish Boiler	3C30-1	150	0.0	61.4	0.0	501	0.1	12.9 B
4.	Refurbish Boiler	11D47-1	156	0.0	61.7	0.0	503	0.1	12.9 B
4.	Refurbish Boiler	6229-1	285	0.0	61.4	0.0	501	0.1	12.9 B
4.	Refurbish Boiler	11B29-1	149	0.0	60.8	0.0	497	0.1	12.8 B
4.	Refurbish Boiler	2270-1	208	0.0	61.2	0.0	500	0.1	12.8 B
4.	Refurbish Boiler	3725-1	213	0.0	61.2	0.0	500	0.1	12.8 B
4.	Refurbish Boiler	2020B-1	185	0.0	109.6	0.0	821	0.1	12.7 B
4.	Refurbish Boiler	1033-1	161	0.0	60.0	0.0	492	0.1	12.6 B
4.	Refurbish Boiler	2007A-1	278	0.0	84.0	0.0	651	0.1	12.6 B
4.	Refurbish Boiler	2007B-2	278	0.0	84.0	0.0	651	0.1	12.6 B
4.	Refurbish Boiler	2007C-3	278	0.0	84.0	0.0	651	0.1	12.6 B
4.	Refurbish Boiler	2008C-3	279	0.0	84.0	0.0	584.1	3,777	0.1
4.	Refurbish Boiler	2014-1	180	0.0	0.0	0.0	606	0.1	11.7 B
4.	Refurbish Boiler	3292-2	277	0.0	0.0	0.0	77.2	0.0	11.6 B
4.	Refurbish Boiler	4076-1	219	0.0	0.0	0.0	452	0.1	11.6 B
4.	Refurbish Boiler	10B8-1	148	0.0	53.9	0.0	454	0.1	11.6 B
4.	Refurbish Boiler	2014-1	180	0.0	54.3	0.0	874	0.1	11.6 B
4.	Refurbish Boiler	2162-3	202	0.0	132.3	0.0	450	0.1	11.5 B
4.	Refurbish Boiler	9504-1	263	0.0	53.7	0.0	595	0.1	11.5 B
4.	Refurbish Boiler	9997-1	275	0.0	75.5	0.0	595	0.1	11.5 B
4.	Refurbish Boiler	9998-1	276	0.0	75.5	0.0	595	0.1	11.5 B

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## PRIORITY ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	No.	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to Invest Ratio	Maintenace Code
				Elec	Nat Gas	2 oil	6 oil				
4.	Refurbish Boiler	3E48-1	57	0.0	0.0	52.7	0.0	444	0.1	0.7	11.3 B
4.	Refurbish Boiler	4292-1	228	0.0	0.0	51.9	0.0	439	0.1	0.7	11.2 B
4.	Refurbish Boiler	2015A-1	181	0.0	0.0	70.9	0.0	564	0.1	0.7	10.9 B
4.	Refurbish Boiler	9620-1	267	0.0	0.0	89.5	0.0	687	0.1	0.7	10.6 B
4.	Refurbish Boiler	9503-1	262	0.0	0.0	67.7	0.0	543	0.1	0.7	10.5 B
4.	Refurbish Boiler	2162-1	202	0.0	0.0	108.1	0.0	811	0.1	0.7	10.5 B
4.	Refurbish Boiler	1161-1	165	0.0	0.0	66.5	0.0	535	0.1	0.8	10.3 B
4.	Refurbish Boiler	5209-1	252	0.0	0.0	44.9	0.0	392	0.1	0.8	10.0 B
4.	Refurbish Boiler	9641-2	269	0.0	0.0	64.5	0.0	522	0.1	0.8	10.0 B
4.	Refurbish Boiler	3A3-1	111	0.0	0.0	44.2	0.0	388	0.1	0.8	9.9 B
4.	Refurbish Boiler	2109-1	200	0.0	0.0	43.8	0.0	385	0.1	0.8	9.8 B
4.	Refurbish Boiler	4071-1	217	0.0	0.0	61.8	0.0	504	0.1	0.8	9.7 B
4.	Refurbish Boiler	1501-1	173	0.0	0.0	42.8	0.0	378	0.1	0.8	9.6 B
4.	Refurbish Boiler	1E20-1	105	0.0	0.0	42.2	0.0	374	0.1	0.8	9.5 B
4.	Refurbish Boiler	5182-1	251	0.0	0.0	40.2	0.0	361	0.1	0.8	9.2 B
4.	Refurbish Boiler	5173-1	284	0.0	0.0	40.4	0.0	362	0.1	0.8	9.2 B
4.	Refurbish Boiler	1034-1	162	0.0	0.0	39.8	0.0	358	0.1	0.8	9.1 B
4.	Refurbish Boiler	5E2-1	77	0.0	0.0	39.1	0.0	354	0.1	0.9	9.0 B
4.	Refurbish Boiler	4274-1	225	0.0	0.0	39.3	0.0	355	0.1	0.9	9.0 B
4.	Refurbish Boiler	5E3-1	78	0.0	0.0	38.4	0.0	349	0.1	0.9	8.9 B
4.	Refurbish Boiler	4127-1	221	0.0	0.0	38.3	0.0	349	0.1	0.9	8.8 B
4.	Refurbish Boiler	4218-1	223	0.0	0.0	37.8	0.0	345	0.1	0.9	8.7 B
4.	Refurbish Boiler	9670-1	273	0.0	0.0	117.2	0.0	871	0.1	0.9	8.5 B
4.	Refurbish Boiler	2004-1	176	0.0	0.0	35.9	0.0	333	0.1	0.9	8.3 B
4.	Refurbish Boiler	2103-1	199	0.0	0.0	38.4	0.0	321	0.1	0.9	8.1 B
4.	Refurbish Boiler	4336-1	230	0.0	0.0	34.6	0.0	324	0.1	0.9	8.0 B
4.	Refurbish Boiler	9631-1	268	0.0	0.0	193.0	0.0	1,232	0.1	1.1	7.0 B
4.	Refurbish Boiler	8085-1	260	0.0	0.0	40.4	0.0	333	0.1	1.2	6.4 B
4.	Refurbish Boiler	4E24-1	70	0.0	0.0	26.9	0.0	273	0.1	1.1	6.2 B
4.	Refurbish Boiler	2022-1	192	0.0	0.0	36.0	0.0	333	0.1	1.2	6.2 B
4.	Refurbish Boiler	2022-2	192	0.0	0.0	36.0	0.0	268	0.1	1.1	6.0 B
4.	Refurbish Boiler	3E12-1	51	0.0	0.0	26.2	0.0	378	0.1	1.3	5.9 B
		9665-1	271	0.0	0.0	48.0	0.0				

TABLE E-3

Analysis Date: October 1988

## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	No.	Million Btu's per Year Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to Invest Ratio	Maintenance Code
4. Refurbish Boiler	1017-1	159	0.0	24.2	0.0	255	0.1	1.2	5.6 B
4. Refurbish Boiler	4291-1	227	0.0	24.3	0.0	256	0.1	1.2	5.6 B
4. Refurbish Boiler	3A10-1	112	0.0	38.9	0.0	353	0.1	1.4	5.4 B
4. Refurbish Boiler	9A1-1	137	0.0	22.5	0.0	244	0.1	1.2	5.2 B
4. Refurbish Boiler	1452-1	172	0.0	29.8	0.0	292	0.1	1.4	5.2 B
4. Refurbish Boiler	4174-1	222	0.0	29.4	0.0	290	0.1	1.4	5.1 B
4. Refurbish Boiler	4174-1	222	0.0	21.5	0.0	237	0.1	1.3	5.0 B
4. Refurbish Boiler	5E23-1	83	0.0	35.4	0.0	329	0.1	1.5	4.9 B
4. Refurbish Boiler	2045-1	196	0.0	0.0	0.0	229	0.1	1.3	4.7 B
4. Refurbish Boiler	7E4-1	4	0.0	0.0	0.0	229	0.1	1.3	4.7 B
4. Refurbish Boiler	8E4-1	19	0.0	0.0	0.0	229	0.1	1.3	4.7 B
4. Refurbish Boiler	4E1-1	62	0.0	0.0	0.0	229	0.1	1.3	4.7 B
4. Refurbish Boiler	6E29-1	103	0.0	0.0	0.0	229	0.1	1.3	4.7 B
4. Refurbish Boiler	4432-1	232	0.0	0.0	0.0	229	0.1	1.3	4.7 B
4. Refurbish Boiler	7E27-1	12	0.0	0.0	0.0	226	0.1	1.3	4.6 B
4. Refurbish Boiler	7E28-1	13	0.0	0.0	0.0	226	0.1	1.3	4.6 B
4. Refurbish Boiler	8E25-1	26	0.0	0.0	0.0	227	0.1	1.3	4.6 B
4. Refurbish Boiler	8E26-1	27	0.0	0.0	0.0	227	0.1	1.3	4.6 B
4. Refurbish Boiler	9E3-1	34	0.0	0.0	0.0	227	0.1	1.3	4.6 B
4. Refurbish Boiler	9E25-1	42	0.0	0.0	0.0	226	0.1	1.3	4.6 B
4. Refurbish Boiler	5E5-1	80	0.0	0.0	0.0	226	0.1	1.3	4.6 B
4. Refurbish Boiler	5E26-1	86	0.0	0.0	0.0	226	0.1	1.3	4.6 B
4. Refurbish Boiler	6E6-1	95	0.0	0.0	0.0	226	0.1	1.3	4.6 B
4. Refurbish Boiler	6E23-1	97	0.0	0.0	0.0	226	0.1	1.3	4.6 B
4. Refurbish Boiler	4433-1	233	0.0	0.0	0.0	226	0.1	1.3	4.6 B
4. Refurbish Boiler	4435-1	235	0.0	0.0	0.0	227	0.1	1.3	4.6 B
4. Refurbish Boiler	4447-1	241	0.0	0.0	0.0	227	0.1	1.3	4.6 B
4. Refurbish Boiler	4449-1	243	0.0	0.0	0.0	227	0.1	1.3	4.6 B
4. Refurbish Boiler	4450-1	244	0.0	0.0	0.0	226	0.1	1.3	4.6 B
4. Refurbish Boiler	4451-1	245	0.0	0.0	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	7E2-1	2	0.0	0.0	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	7E3-1	3	0.0	0.0	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	7E5-1	5	0.0	0.0	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	7E6-1	6	0.0	0.0	0.0	225	0.1	1.3	4.5 B

TABLE E-3

Analysis Date: October 1988

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year Savings			Annual Dollar Savings (\$000)	Construction Cost (\$000)	Simple Payback years	Save-to Invest Ratio	Maintenance Code
			Elec	Nat Gas	Oil					
4. Refurbish Boiler	7E7-1	7	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	7E24-1	9	0.0	0.0	19.7	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	7E25-1	10	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	7E26-1	11	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	7E29-1	14	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	8E2-1	17	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	8E3-1	18	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	8E5-1	20	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	8E6-1	21	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	8E7-1	22	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	8E24-1	25	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	8E27-1	28	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	8E28-1	29	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	8E29-1	30	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	9E4-1	35	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	9E5-1	36	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	9E6-1	37	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	9E7-1	38	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	9E24-1	41	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	9E26-1	43	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	9E27-1	44	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	9E28-1	45	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	9E29-1	46	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	4E6-1	67	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	4E7-1	68	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	4E28-1	74	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	4E29-1	75	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	5E7-1	82	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	5E25-1	85	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	5E27-1	87	0.0	0.0	19.7	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	5E28-1	88	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	5E29-1	89	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	6E2-1	91	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B

TABLE E-3

Analysis Date: October 1988

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
			Elec	Nat Gas	2 oil					
4. Refurbish Boiler	6E3-1	92	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	6E4-1	93	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	6E5-1	94	0.0	0.0	19.4	0.0	223	0.1	1.4	4.5 B
4. Refurbish Boiler	6E24-1	98	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	6E26-1	100	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	6E27-1	101	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	6E28-1	102	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	1E15-1	104	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	6A7-1	119	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	4A34-1	234	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	4A46-1	240	0.0	0.0	19.6	0.0	225	0.1	1.3	4.5 B
4. Refurbish Boiler	4A48-1	242	0.0	0.0	19.6	0.0	267	0.1	1.5	4.5 B
4. Refurbish Boiler	2008B-2	279	0.0	0.0	26.0	0.0	221	0.1	1.4	4.4 B
4. Refurbish Boiler	9E1-1	32	0.0	0.0	19.1	0.0	221	0.1	1.4	4.4 B
4. Refurbish Boiler	4E23-1	69	0.0	0.0	19.1	0.0	221	0.1	1.4	4.4 B
4. Refurbish Boiler	5E1-1	76	0.0	0.0	18.9	0.0	220	0.1	1.4	4.4 B
4. Refurbish Boiler	5E4-1	79	0.0	0.0	18.9	0.0	220	0.1	1.4	4.4 B
4. Refurbish Boiler	5E6-1	81	0.0	0.0	19.1	0.0	221	0.1	1.4	4.4 B
4. Refurbish Boiler	6E1-1	90	0.0	0.0	19.1	0.0	221	0.1	1.4	4.4 B
4. Refurbish Boiler	8A27-1	132	0.0	0.0	19.1	0.0	221	0.1	1.4	4.4 B
4. Refurbish Boiler	9A8-1	142	0.0	0.0	19.1	0.0	450	0.1	1.8	4.4 B
4. Refurbish Boiler	9580-4	266	0.0	0.0	60.2	0.0	217	0.1	1.4	4.3 B
4. Refurbish Boiler	3E38-1	54	0.0	0.0	18.5	0.0	219	0.1	1.4	4.3 B
4. Refurbish Boiler	6E25-1	99	0.0	0.0	18.8	0.0	218	0.1	1.4	4.3 B
4. Refurbish Boiler	9550-1	265	0.0	0.0	18.6	0.0	212	0.1	1.4	4.1 B
4. Refurbish Boiler	2003-1	175	0.0	0.0	17.6	0.0	213	0.1	1.4	4.1 B
4. Refurbish Boiler	3E90-1	61	0.0	0.0	17.9	0.0	213	0.1	1.4	4.1 B
4. Refurbish Boiler	1015-1	158	0.0	0.0	17.8	0.0	249	0.1	1.6	4.1 B
4. Refurbish Boiler	2027-1	195	0.0	0.0	26.1	0.0	210	0.1	1.4	4.0 B
4. Refurbish Boiler	5E24-1	84	0.0	0.0	17.3	0.0	248	0.1	1.6	4.0 B
4. Refurbish Boiler	1227-1	167	0.0	0.0	23.1	0.0	211	0.1	1.4	4.0 B
4. Refurbish Boiler	4A37-1	237	0.0	0.0	17.5	0.0	239	0.1	1.7	3.8 B
4. Refurbish Boiler	1010-1	157	0.0	0.0	21.7	0.0				

TABLE E-3

Analysis Date: October 1988

## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	No.	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
				Elec	Nat Gas	2 oil	6 oil				
4.	Refurbish Boiler	2008A-1	279	0.0	0.0	22.0	0.0	241	0.1	1.7	3.8 B
4.	Refurbish Boiler	2068-1	198	0.0	0.0	16.2	0.0	202	0.1	1.5	3.7 B
4.	Refurbish Boiler	2025-1	193	0.0	28.5	0.0	0.0	263	0.1	1.9	3.6 B
4.	Refurbish Boiler	2026-2	194	0.0	21.9	0.0	0.0	224	0.1	1.8	3.5 B
4.	Refurbish Boiler	3E53-1	280	0.0	0.0	14.6	0.0	192	0.1	1.6	3.4 B
4.	Refurbish Boiler	9A32-1	145	0.0	0.0	12.8	0.0	180	0.1	1.7	3.0 B
4.	Refurbish Boiler	4074-1	218	0.0	0.0	13.2	0.0	182	0.1	1.7	3.0 B
4.	Refurbish Boiler	3E6-1	50	0.0	0.0	12.5	0.0	178	0.1	1.7	2.9 B
4.	Refurbish Boiler	3E55-1	59	0.0	0.0	12.5	0.0	178	0.1	1.7	2.9 B
4.	Refurbish Boiler	4E4-1	65	0.0	0.0	12.4	0.0	177	0.1	1.7	2.9 B
4.	Refurbish Boiler	4E26-1	72	0.0	0.0	12.4	0.0	177	0.1	1.7	2.9 B
4.	Refurbish Boiler	4E27-1	73	0.0	0.0	12.4	0.0	177	0.1	1.7	2.9 B
4.	Refurbish Boiler	6A3-1	116	0.0	0.0	12.5	0.0	178	0.1	1.7	2.9 B
4.	Refurbish Boiler	6A4-1	117	0.0	0.0	12.5	0.0	178	0.1	1.7	2.9 B
4.	Refurbish Boiler	6A32-1	120	0.0	0.0	12.4	0.0	177	0.1	1.7	2.9 B
4.	Refurbish Boiler	6A33-1	121	0.0	0.0	12.5	0.0	178	0.1	1.7	2.9 B
4.	Refurbish Boiler	8A28-1	133	0.0	0.0	12.4	0.0	177	0.1	1.7	2.9 B
4.	Refurbish Boiler	8A29-1	134	0.0	0.0	12.5	0.0	178	0.1	1.7	2.9 B
4.	Refurbish Boiler	8A33-1	136	0.0	0.0	12.7	0.0	179	0.1	1.7	2.9 B
4.	Refurbish Boiler	9A2-1	138	0.0	0.0	12.4	0.0	177	0.1	1.7	2.9 B
4.	Refurbish Boiler	9A7-1	141	0.0	0.0	12.5	0.0	178	0.1	1.7	2.9 B
4.	Refurbish Boiler	9A28-1	143	0.0	0.0	12.7	0.0	179	0.1	1.7	2.9 B
4.	Refurbish Boiler	9A29-1	144	0.0	0.0	12.4	0.0	177	0.1	1.7	2.9 B
4.	Refurbish Boiler	9A33-1	146	0.0	0.0	12.4	0.0	177	0.1	1.7	2.9 B
4.	Refurbish Boiler	1036-1	163	0.0	0.0	12.5	0.0	178	0.1	1.7	2.9 B
4.	Refurbish Boiler	1037-1	164	0.0	0.0	12.5	0.0	176	0.1	1.7	2.9 B
4.	Refurbish Boiler	9E2-1	33	0.0	0.0	12.3	0.0	176	0.1	1.7	2.8 B
4.	Refurbish Boiler	2E1-1	49	0.0	0.0	12.3	0.0	176	0.1	1.7	2.8 B
4.	Refurbish Boiler	3E43-1	55	0.0	0.0	12.3	0.0	176	0.1	1.7	2.8 B
4.	Refurbish Boiler	3E44-1	56	0.0	0.0	12.3	0.0	176	0.1	1.7	2.8 B
4.	Refurbish Boiler	3E54-1	58	0.0	0.0	12.3	0.0	176	0.1	1.7	2.8 B
4.	Refurbish Boiler	3E56-1	60	0.0	0.0	12.3	0.0	176	0.1	1.7	2.8 B
4.	Refurbish Boiler	4E2-1	63	0.0	0.0	12.0	0.0	174	0.1	1.7	2.8 B

## PRIORITIZED ECO SUMMARY

Analysis Date: October 1988

TABLE E-3

ECO No.	ECO Name	Building-Boiler Survey No.	Million Btu's per Year Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-invest Ratio	Maintenance Code
4. Refurbish Boiler	4E3-1	64	0.0	12.0	174	0.1	1.7	B
4. Refurbish Boiler	4E5-1	66	0.0	12.2	176	0.1	1.7	B
4. Refurbish Boiler	4E25-1	71	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	1E40-1	106	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	1E47-1	107	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	1E55-1	108	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	6A2-1	115	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	6A36-1	122	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	6A37-1	123	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	6A40-1	126	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	6A41-1	127	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	8A2-1	128	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	8A3-1	129	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	8A6-1	130	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	8A7-1	131	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	8A32-1	135	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	9A3-1	139	0.0	12.3	176	0.1	1.7	B
4. Refurbish Boiler	9A6-1	140	0.0	11.7	172	0.1	1.8	B
4. Refurbish Boiler	6A6-1	118	0.0	10.8	166	0.1	1.8	B
4. Refurbish Boiler	3E15-1	52	0.0	10.6	165	0.1	1.8	B
4. Refurbish Boiler	3E16-1	53	0.0	9.2	156	0.1	1.9	B
4. Refurbish Boiler	5137-1	250	0.0	8.1	149	0.1	2.0	B
4. Refurbish Boiler	9D30-1	153	0.0	8.1	149	0.1	2.0	B
4. Refurbish Boiler	9D38-1	154	0.0	7.6	145	0.1	2.1	B
4. Refurbish Boiler	6071-1	254	0.0	7.4	144	0.1	2.1	B
4. Refurbish Boiler	4431-1	231	0.0	7.4	159	0.1	2.1	B
4. Refurbish Boiler	2027-2	195	0.0	10.9	140	0.1	2.2	B
4. Refurbish Boiler	7E1-1	0	0.0	6.8	137	0.1	2.2	B
4. Refurbish Boiler	7E23-1	8	0.0	6.3	137	0.1	2.2	B
4. Refurbish Boiler	7E30-1	15	0.0	6.3	137	0.1	2.2	B
4. Refurbish Boiler	8E1-1	16	0.0	6.3	137	0.1	2.2	B
4. Refurbish Boiler	8E23-1	24	0.0	6.3	137	0.1	2.2	B
4. Refurbish Boiler	8E30-1	31	0.0	6.3	137	0.1	2.2	B

TABLE E-3

Analysis Date: October 1988

## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	No.	Million Btu's per Year	Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to Invest Ratio	Maintenance Code
4.	Refurbish Boiler	9E8-1	39	0.0	0.0	6.3	0.0	137	0.1	2.2
4.	Refurbish Boiler	9E23-1	40	0.0	0.0	6.6	0.0	139	0.1	2.2
4.	Refurbish Boiler	4436-1	236	0.0	0.0	6.5	0.0	138	0.1	2.2
4.	Refurbish Boiler	4444-1	238	0.0	0.0	6.6	0.0	139	0.1	2.2
4.	Refurbish Boiler	4445-1	239	0.0	0.0	6.4	0.0	137	0.1	2.2
4.	Refurbish Boiler	6133-1	256	0.0	0.0	6.3	0.0	137	0.1	2.2
4.	Refurbish Boiler	6203-1	258	0.0	0.0	6.3	0.0	137	0.1	2.2
4.	Refurbish Boiler	6165-1	257	0.0	0.0	6.0	0.0	135	0.1	2.2
4.	Refurbish Boiler	9E30-1	47	0.0	0.0	5.8	0.0	133	0.1	2.3
4.	Refurbish Boiler	1020-1	160	0.0	0.0	6.4	0.0	133	0.1	2.3
4.	Refurbish Boiler	8E8-1	23	0.0	0.0	4.8	0.0	127	0.1	2.4
12.	Reduce Infiltr'tn	7500-1	259	0.0	0.0	65.2	0.0	432	0.5	1.2
33.	Insul Oil Tank	3850-2	214	0.0	0.0	929.9	5,812	19.7	9.7	C
12.	Reduce Infiltr'tn	1452-2	172	0.0	0.0	21.3	0.0	141	0.5	3.6
12.	Reduce Infiltr'tn	1450-2	171	0.0	0.0	17.7	0.0	117	0.5	4.3
12.	Reduce Infiltr'tn	9641-2	269	0.0	0.0	12.9	0.0	85	0.5	5.9
12.	Reduce Infiltr'tn	4071-1	217	0.0	0.0	12.4	0.0	82	0.5	6.1
12.	Reduce Infiltr'tn	9997-1	275	0.0	0.0	11.9	0.0	79	0.5	6.4
12.	Reduce Infiltr'tn	9998-1	276	0.0	0.0	11.9	0.0	79	0.5	6.4
12.	Reduce Infiltr'tn	9500-1	261	0.0	0.0	8.2	0.0	54	0.5	9.3
12.	Reduce Infiltr'tn	1452-1	172	0.0	0.0	7.8	0.0	52	0.5	9.7
13.	Flue Dampers	6D35-1	152	0.0	0.0	344.7	0.0	2,093	0.8	0.4
13.	Flue Dampers	4076-1	219	0.0	0.0	282.7	0.0	1,682	0.8	0.5
13.	Flue Dampers	4336-1	230	0.0	0.0	220.0	0.0	1,267	0.8	0.6
13.	Flue Dampers	9504-1	263	0.0	0.0	214.9	0.0	1,234	0.8	0.7
13.	Flue Dampers	3C30-1	150	0.0	0.0	202.7	0.0	1,153	0.8	0.7
13.	Flue Dampers	11B29-1	149	0.0	0.0	199.5	0.0	1,132	0.8	0.7
13.	Flue Dampers	9641-2	269	0.0	0.0	185.0	0.0	1,036	0.8	0.8
8.	Stack Heat Rcvry	3850-4	214	0.0	0.0	0.0	7,027.0	43,604	31.4	D
13.	Flue Dampers	9998-1	276	0.0	0.0	182.3	0.0	1,018	0.8	0.8
13.	Flue Dampers	9998-2	276	0.0	0.0	180.4	0.0	1,005	0.8	0.8
13.	Flue Dampers	9997-2	275	0.0	0.0	178.8	0.0	995	0.8	0.8
13.	Flue Dampers	1450-2	171	0.0	0.0	178.6	0.0	993	0.8	0.8

TABLE E-3

Analysis Date: October 1988

## PRIORITIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
		No.	Elec Nat Gas	2 0 i l	6 0 i l			
13. Flue Dampers	1452-1	172	0.0	198.2	0.0	1,123	0.9	D
8. Stack Heat Rcvry	3850-2	214	0.0	0.0	6,485.2	40,218	29.7	D
13. Flue Dampers	3725-1	213	0.0	0.0	177.5	0.0	0.8	D
13. Flue Dampers	2270-1	208	0.0	0.0	176.5	0.0	0.8	D
13. Flue Dampers	9997-1	275	0.0	0.0	169.3	0.0	0.9	D
13. Flue Dampers	3A38-1	114	0.0	0.0	163.6	0.0	0.9	D
13. Flue Dampers	2493-1	212	0.0	0.0	162.3	0.0	0.9	D
5. Optimize Schedule	9785-4	274	0.0	1,294.1	0.0	7,622	0.0	D
13. Flue Dampers	2022-2	192	0.0	0.0	144.5	0.0	0.8	D
13. Flue Dampers	2022-1	192	0.0	0.0	143.7	0.0	0.8	D
13. Flue Dampers	11D47-1	156	0.0	0.0	137.1	0.0	0.8	D
13. Flue Dampers	3E48-1	57	0.0	0.0	132.2	0.0	0.8	D
13. Flue Dampers	4071-1	217	0.0	0.0	122.9	0.0	0.8	D
8. Stack Heat Rcvry	9785-4	274	0.0	3,984.4	0.0	23,153	0.8	D
13. Flue Dampers	14A26-1	147	0.0	0.0	112.7	0.0	0.8	D
13. Flue Dampers	3E90-1	61	0.0	0.0	102.7	0.0	0.8	D
13. Flue Dampers	4074-1	218	0.0	0.0	96.2	0.0	0.8	D
13. Flue Dampers	1263-1	168	0.0	0.0	97.7	0.0	0.9	D
14. Barometric Damper	7500-2	259	0.0	0.0	30.7	0.0	1.6	D
13. Flue Dampers	4274-1	225	0.0	0.0	84.8	0.0	0.8	D
14. Barometric Damper	1401-1	169	0.0	0.0	106.2	0.0	0.7	D
14. Barometric Damper	3292-2	277	0.0	0.0	0.0	136.3	0.0	D
13. Flue Dampers	6133-1	256	0.0	0.0	79.8	0.0	0.8	D
10. Preheat Cmb Air	9785-4	274	0.0	0.0	935.5	0.0	5,321	D
14. Barometric Damper	1263-1	168	0.0	0.0	31.0	0.0	0.4	D
10. Preheat Cmb Air	3850-2	214	0.0	0.0	0.0	843.3	5,082	D
13. Flue Dampers	4127-1	221	0.0	0.0	71.6	0.0	0.8	D
13. Flue Dampers	1033-1	161	0.0	0.0	70.3	0.0	0.8	D
8. Stack Heat Rcvry	7500-1	259	0.0	0.0	685.5	0.0	4,317	D
13. Flue Dampers	3A10-1	112	0.0	0.0	67.8	0.0	0.8	D
14. Barometric Damper	9620-1	267	0.0	0.0	22.4	0.0	101	D
13. Flue Dampers	2013-1	179	0.0	0.0	65.6	0.0	245	D
13. Flue Dampers	7500-1	259	0.0	0.0	64.6	0.0	239	D

TABLE E-3

Analysis Date: October 1988

## PRIORITIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	No.	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
15. Draft Control	Draft Control	9785-4	274	0.0	151.8	0.0	0.0	799	2.4	3.0	5.0 D
14. Barometric Damper	Barometric Damper	9631-1	268	0.0	50.7	0.0	0.0	252	0.8	3.2	4.8 D
14. Barometric Damper	Barometric Damper	2020D-1	187	0.0	0.0	20.5	0.0	89	0.3	3.4	4.7 D
13. Flue Dampers	Flue Dampers	1501-1	173	0.0	0.0	60.6	0.0	212	0.8	3.8	4.6 D
14. Barometric Damper	Barometric Damper	2021B-1	189	0.0	0.0	20.2	0.0	87	0.3	3.5	4.6 D
13. Flue Dampers	Flue Dampers	9503-1	262	0.0	0.0	59.6	0.0	206	0.8	3.9	4.5 D
8. Stack Heat Rcvry	Stack Heat Rcvry	1263-1	168	0.0	0.0	675.9	0.0	4,222	13.6	3.2	4.4 D
13. Flue Dampers	Flue Dampers	9550-1	265	0.0	0.0	59.1	0.0	202	0.8	4.0	4.4 D
8. Stack Heat Rcvry	Stack Heat Rcvry	7500-2	259	0.0	0.0	550.9	0.0	3,426	11.6	3.4	4.2 D
13. Flue Dampers	Flue Dampers	2027-1	195	0.0	66.9	0.0	0.0	205	0.9	4.4	4.2 D
10. Preheat Cmb Air	Preheat Cmb Air	3850-4	214	0.0	0.0	786.2	0.0	4,725	18.1	3.9	4.1 D
14. Barometric Damper	Barometric Damper	2020A-1	184	0.0	0.0	18.1	0.0	73	0.3	4.1	4.0 D
14. Barometric Damper	Barometric Damper	2020C-1	186	0.0	0.0	18.1	0.0	73	0.3	4.1	4.0 D
13. Flue Dampers	Flue Dampers	1401-1	169	0.0	120.7	0.0	0.0	333	1.7	5.1	3.8 D
14. Barometric Damper	Barometric Damper	2021A-1	188	0.0	0.0	17.6	0.0	70	0.3	4.3	3.8 D
14. Barometric Damper	Barometric Damper	2021C-1	190	0.0	0.0	17.6	0.0	70	0.3	4.3	3.8 D
14. Barometric Damper	Barometric Damper	2021D-1	191	0.0	0.0	17.6	0.0	70	0.3	4.3	3.8 D
15. Draft Control	Draft Control	9631-1	268	0.0	101.3	0.0	0.0	502	2.0	4.0	3.8 D
13. Flue Dampers	Flue Dampers	8A27-1	132	0.0	0.0	52.4	0.0	158	0.8	5.1	3.6 D
13. Flue Dampers	Flue Dampers	1161-1	165	0.0	0.0	51.8	0.0	154	0.8	5.2	3.6 D
13. Flue Dampers	Flue Dampers	6165-1	257	0.0	0.0	51.9	0.0	155	0.8	5.2	3.6 D
8. Stack Heat Rcvry	Stack Heat Rcvry	9670-1	273	0.0	0.0	323.2	0.0	1,951	8.4	4.3	3.4 D
8. Stack Heat Rcvry	Stack Heat Rcvry	9620-1	267	0.0	0.0	386.9	0.0	2,340	10.6	4.6	3.2 D
13. Flue Dampers	Flue Dampers	2027-2	195	0.0	53.2	0.0	0.0	124	0.8	6.5	3.2 D
15. Draft Control	Draft Control	7500-2	259	0.0	0.0	61.5	0.0	312	1.5	4.8	3.2 D
5. Optimize Schedule	Optimize Schedule	9580-4	266	0.0	258.4	0.0	0.0	1,522	0.0	5.7	3.1 D
14. Barometric Damper	Barometric Damper	3A10-1	112	0.0	0.0	15.0	0.0	52	0.3	5.8	3.0 D
14. Barometric Damper	Barometric Damper	2166-1	206	0.0	0.0	14.9	0.0	52	0.3	5.8	3.0 D
15. Draft Control	Draft Control	1263-1	168	0.0	0.0	61.9	0.0	315	1.6	5.1	3.0 D
28. Air Atomization	Air Atomization	3850-2	214	-27.8	0.0	0.0	954.3	5,002	27.3	5.5	3.0 D
13. Flue Dampers	Flue Dampers	9665-1	271	0.0	53.1	0.0	0.0	124	0.9	7.3	2.9 D
14. Barometric Damper	Barometric Damper	1452-2	172	0.0	0.0	17.8	0.0	71	0.4	5.7	2.9 D
8. Stack Heat Rcvry	Stack Heat Rcvry	9641-1	269	0.0	402.9	0.0	0.0	2,415	12.4	5.2	2.8 D

TABLE E-3

Analysis Date: October 1988

## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year Savings			Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
			Elec	Nat Gas	2 oil					
13. Flue Dampers	13C53-1	151	0.0	0.0	45.6	0.0	113	0.8	7.1	2.8
13. Flue Dampers	2068-1	198	0.0	0.0	47.5	0.0	125	0.9	7.2	2.7
13. Flue Dampers	6E1-1	90	0.0	0.0	43.4	0.0	98	0.8	8.2	2.6
14. Barometric Damper	2054-1	197	0.0	0.0	13.5	0.0	42	0.3	7.2	2.6
16. Lo X-Air Burner	1401-1	169	0.0	1,084.0	0.0	0.0	6,574	38.5	5.9	2.6
8. Stack Heat Rcvry	2008B-2	279	0.0	0.0	247.6	0.0	1,450	8.4	5.8	2.5
8. Stack Heat Rcvry	2054-1	197	0.0	0.0	303.8	0.0	1,790	10.5	5.9	2.5
8. Stack Heat Rcvry	2166-1	206	0.0	0.0	340.5	0.0	2,002	12.1	6.1	2.4
10. Preheat Cmb Air	3292-1	277	0.0	0.0	637.3	0.0	3,565	26.5	7.5	2.4
13. Flue Dampers	4E1-1	62	0.0	0.0	41.5	0.0	86	0.8	9.4	2.4
8. Stack Heat Rcvry	2020D-1	187	0.0	0.0	268.6	0.0	1,557	9.7	6.3	2.3
8. Stack Heat Rcvry	2021B-1	189	0.0	0.0	264.3	0.0	1,529	9.7	6.4	2.3
28. Air Atomization	3850-4	214	-32.3	0.0	0.0	1,110.1	5,942	41.5	7.0	2.3
13. Flue Dampers	2004-1	176	0.0	0.0	39.4	0.0	72	0.8	11.2	2.1
13. Flue Dampers	96669-1	272	0.0	0.0	39.4	0.0	72	0.8	11.2	2.1
14. Barometric Damper	2020B-1	185	0.0	0.0	12.2	0.0	34	0.3	8.9	2.1
15. Draft Control	9620-1	267	0.0	0.0	44.8	0.0	202	1.5	7.5	2.1
8. Stack Heat Rcvry	4320-1	229	0.0	0.0	304.9	0.0	1,766	12.7	7.2	2.0
13. Flue Dampers	1015-1	158	0.0	0.0	38.1	0.0	63	0.8	12.8	2.0
13. Flue Dampers	5209-1	252	0.0	0.0	38.4	0.0	65	0.8	12.4	2.0
14. Barometric Damper	2110-1	201	0.0	12.6	0.0	0.0	27	0.3	11.2	2.0
14. Barometric Damper	2140-1	203	0.0	0.0	11.7	0.0	30	0.3	10.1	2.0
8. Stack Heat Rcvry	9500-1	261	0.0	0.0	308.6	0.0	1,791	13.9	7.8	1.9
10. Preheat Cmb Air	9631-1	268	0.0	181.7	0.0	0.0	881	8.5	9.7	1.9
13. Flue Dampers	2015A-1	181	0.0	0.0	37.8	0.0	61	0.8	13.2	1.9
13. Flue Dampers	5227-1	253	0.0	0.0	37.9	0.0	62	0.8	13.0	1.9
8. Stack Heat Rcvry	2020A-1	184	0.0	0.0	216.5	0.0	1,212	10.2	8.5	1.8
8. Stack Heat Rcvry	2020C-1	186	0.0	0.0	216.5	0.0	1,212	10.2	8.5	1.8
13. Flue Dampers	3A2-1	110	0.0	0.0	36.3	0.0	51	0.8	15.8	1.8
14. Barometric Damper	2015B-1	182	0.0	0.0	11.1	0.0	26	0.3	11.6	1.8
14. Barometric Damper	9669-1	272	0.0	0.0	11.0	0.0	26	0.3	11.6	1.8
8. Stack Heat Rcvry	2021A-1	188	0.0	0.0	198.8	0.0	1,095	9.7	8.9	1.7
8. Stack Heat Rcvry	2021C-1	190	0.0	0.0	198.8	0.0	1,095	9.7	8.9	1.7

TABLE E-3

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## PRIORITY ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	Million Btu's per Year Savings			Annual Dollar Savings (\$000)	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
8.	Stack Heat Rcvry	2021D-1	191	0.0	0.0	198.8	0.0	1,095	9.7	8.9
8.	Stack Heat Rcvry	2202-1	207	0.0	0.0	234.3	0.0	1,330	11.5	8.7
8.	Stack Heat Rcvry	9669-1	272	0.0	0.0	252.3	0.0	1,418	12.2	8.7
14.	Barometric Damper	9641-2	269	0.0	0.0	10.8	0.0	24	0.3	12.6
13.	Flue Dampers	10B8-1	148	0.0	0.0	34.8	0.0	41	0.8	19.6
15.	Draft Control	2020A-1	184	0.0	0.0	36.1	0.0	144	1.5	10.5
15.	Draft Control	2020C-1	186	0.0	0.0	36.1	0.0	144	1.5	10.5
15.	Draft Control	7500-1	259	0.0	0.0	36.2	0.0	145	1.5	10.4
5.	Optimize Schedule	3850-2	214	0.0	0.0	979.7	6,123	0.0	10.4	1.6
8.	Stack Heat Rcvry	9631-1	268	0.0	425.6	0.0	2,223	22.4	10.1	1.5
10.	Preheat Cmb Air	2054-1	197	0.0	0.0	50.7	0.0	147	2.3	15.7
10.	Preheat Cmb Air	2166-1	206	0.0	0.0	63.1	0.0	229	3.1	13.6
13.	Flue Dampers	4174-1	222	0.0	0.0	34.3	0.0	38	0.8	21.2
8.	Stack Heat Rcvry	2110-1	201	0.0	196.6	0.0	0.0	937	10.3	11.1
10.	Preheat Cmb Air	3292-2	277	0.0	0.0	387.2	2,231	26.5	12.0	1.4
15.	Draft Control	1452-2	172	0.0	0.0	35.5	0.0	140	1.6	11.5
8.	Stack Heat Rcvry	2015B-1	182	0.0	0.0	158.4	0.0	828	9.7	11.8
8.	Stack Heat Rcvry	9641-2	269	0.0	0.0	183.0	0.0	990	11.6	11.8
8.	Stack Heat Rcvry	2165-1	282	0.0	0.0	168.3	0.0	893	10.5	11.8
8.	Stack Heat Rcvry	9580-5	266	0.0	443.5	0.0	0.0	2,297	30.1	13.2
10.	Preheat Cmb Air	1263-1	168	0.0	0.0	72.2	0.0	289	5.0	17.4
13.	Flue Dampers	2025-1	193	0.0	35.7	0.0	0.0	21	0.9	43.1
13.	Flue Dampers	9580-5	266	0.0	72.0	0.0	0.0	46	1.8	39.4
15.	Draft Control	2166-1	206	0.0	0.0	29.9	0.0	103	1.5	14.7
8.	Stack Heat Rcvry	1450-2	171	0.0	0.0	181.4	0.0	949	12.5	13.3
8.	Stack Heat Rcvry	1452-2	172	0.0	0.0	194.1	0.0	1,033	14.1	13.7
13.	Flue Dampers	2045-1	196	0.0	0.0	31.7	0.0	21	0.9	43.1
15.	Draft Control	3A10-1	112	0.0	0.0	29.9	0.0	103	1.6	15.6
16.	Lo X-Air Burner	3292-1	277	0.0	0.0	797.1	0.0	4,884	69.4	14.3
8.	Stack Heat Rcvry	3A3-1	111	0.0	0.0	128.9	0.0	632	9.4	15.0
8.	Stack Heat Rcvry	14A51-1	281	0.0	0.0	151.6	0.0	783	11.7	15.0
13.	Flue Dampers	9A8-1	142	0.0	0.0	30.2	0.0	11	0.8	73.2
13.	Flue Dampers	1J8-1	48	0.0	0.0	29.9	0.0	9	0.8	89.4

TABLE E-3

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## PRIORITIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	No.	Million Btu's per Year Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
13. Flue Dampers	9641-1	269	0.0	0.0	30.2	0.0	11	0.8	73.2
15. Draft Control	2054-1	197	0.0	0.0	27.0	0.0	84	1.5	18.0
16. Lo X-Air Burner	3292-2	277	0.0	0.0	437.0	0.0	5,132	13.6	1.0
20. Turbulators	9670-1	273	0.0	0.0	455.2	0.0	2,720	1.1	0.4
20. Turbulators	1263-1	168	0.0	0.0	2,808	2.4	0.9	19.6	E
20. Turbulators	2054-1	197	0.0	0.0	1,539	1.4	0.9	9.3	E
20. Turbulators	2021A-1	188	0.0	0.0	198.9	0.0	1,144	1.2	1.1
20. Turbulators	2021C-1	190	0.0	0.0	198.9	0.0	1,144	1.2	1.1
20. Turbulators	2021D-1	191	0.0	0.0	198.9	0.0	1,144	1.2	1.1
20. Turbulators	2020A-1	184	0.0	0.0	209.3	0.0	1,197	1.3	1.1
20. Turbulators	2020C-1	186	0.0	0.0	209.3	0.0	1,197	1.3	1.1
20. Turbulators	2165-1	282	0.0	0.0	192.9	0.0	1,088	1.4	1.3
7. Blr Shutdown	1017-1	159	0.0	0.0	65.0	0.0	430	0.8	1.9
20. Turbulators	2166-1	206	0.0	0.0	259.7	0.0	1,530	2.1	1.4
7. Blr Shutdown	4174-1	222	0.0	0.0	57.5	0.0	381	0.8	2.1
20. Turbulators	2015B-1	182	0.0	0.0	137.5	0.0	737	1.2	1.6
20. Turbulators	2202-1	207	0.0	0.0	192.4	0.0	1,085	1.8	1.7
7. Blr Shutdown	1033-1	161	0.0	0.0	45.5	0.0	301	0.8	2.7
20. Turbulators	9500-1	261	0.0	0.0	216.0	0.0	1,225	2.5	2.1
20. Turbulators	9669-1	272	0.0	0.0	188.9	0.0	1,062	2.2	2.1
7. Blr Shutdown	1010-1	157	0.0	0.0	40.5	0.0	268	0.8	3.0
20. Turbulators	2140-1	203	0.0	0.0	134.6	0.0	702	1.5	2.2
20. Turbulators	1450-2	171	0.0	0.0	181.5	0.0	997	2.3	2.3
20. Turbulators	1452-2	172	0.0	0.0	194.1	0.0	1,080	2.5	2.3
20. Turbulators	2012-1	178	0.0	0.0	142.8	0.0	756	1.9	2.5
20. Turbulators	2013-1	179	0.0	0.0	142.8	0.0	756	1.9	2.5
20. Turbulators	2008B-2	279	0.0	0.0	90.0	0.0	423	1.1	2.6
21. Treat Make-up	3850-4	214	0.0	0.0	0.0	0.0	394.4	1,709	6.6
7. Blr Shutdown	1227-1	167	0.0	0.0	31.4	0.0	208	0.8	3.9
11. Blowdown Ht Rcvry	3850-2	214	0.0	0.0	0.0	0.0	414.5	2,024	10.0
20. Turbulators	2019A-1	183	0.0	0.0	90.4	0.0	425	1.2	2.8
20. Turbulators	2019B-2	183	0.0	0.0	90.4	0.0	425	1.2	2.8
20. Turbulators	2008A-1	279	0.0	0.0	82.1	0.0	371	1.1	3.0

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## PRIORITYIZED ECO SUMMARY

ECO No.	ECO Name	Building-Boiler Survey Number	No.	Million Btu's per Year	Savings	Annual Dollar Savings	Construction Cost (\$000)	Simple Payback years	Save-to-Invest Ratio	Maintenance Code
21. Treat Make-up		3850-2	214	0.0	0.0	339.4	1,459	6.1	4.2	E
20. Turbulators		4290-1	226	0.0	0.0	97.1	0.0	454	3.1	E
20. Turbulators		4290-2	226	0.0	0.0	97.1	0.0	454	3.1	E
20. Turbulators		IJ8-1	48	0.0	0.0	99.1	0.0	467	3.0	E
11. Blowdown Ht Rcvry		3850-4	214	0.0	0.0	481.6	2,065	12.1	5.9	E
20. Turbulators		2007A-1	278	0.0	0.0	75.2	0.0	325	1.1	E
20. Turbulators		2007B-2	278	0.0	0.0	75.2	0.0	325	1.1	E
20. Turbulators		2007C-3	278	0.0	0.0	75.2	0.0	325	1.1	E
20. Turbulators		2008C-3	279	0.0	0.0	75.2	0.0	325	1.1	E
20. Turbulators		14A51-1	281	0.0	0.0	109.1	0.0	533	1.9	E
7. Blr Shutdown		5E2-1	77	0.0	0.0	22.0	0.0	146	0.8	E
7. Blr Shutdown		2103-1	199	0.0	0.0	22.4	0.0	132	0.8	E
7. Blr Shutdown		9670-1	273	0.0	0.0	19.2	0.0	127	0.8	E
20. Turbulators		1227-1	167	0.0	0.0	62.2	0.0	239	1.1	E
21. Treat Make-up		9785-4	274	0.0	0.0	271.1	0.0	841	6.3	E
7. Blr Shutdown		5E3-1	78	0.0	0.0	18.4	0.0	122	0.8	E
7. Blr Shutdown		2020D-1	187	0.0	0.0	18.2	0.0	120	0.8	E
11. Blowdown Ht Rcvry		9785-4	274	0.0	0.0	299.2	0.0	1,006	10.5	E
20. Turbulators		3E53-1	280	0.0	0.0	54.5	0.0	188	1.1	E
20. Turbulators		3A10-1	112	0.0	0.0	94.2	0.0	419	2.3	E
7. Blr Shutdown		2015B-1	182	0.0	0.0	15.4	0.0	102	0.8	E
7. Blr Shutdown		2019A-1	183	0.0	0.0	15.4	0.0	102	0.8	E
7. Blr Shutdown		2019B-2	183	0.0	0.0	15.4	0.0	102	0.8	E
20. Turbulators		2021A-1	188	0.0	0.0	15.4	0.0	102	0.8	E
7. Blr Shutdown		2021C-1	190	0.0	0.0	15.4	0.0	102	0.8	E
7. Blr Shutdown		2021D-1	191	0.0	0.0	15.4	0.0	102	0.8	E
20. Turbulators		14A26-1	147	0.0	0.0	87.5	0.0	374	2.3	E
7. Blr Shutdown		1020-1	160	0.0	0.0	15.4	0.0	91	0.8	E
20. Turbulators		2150-1	204	0.0	0.0	64.9	0.0	193	1.5	E
7. Blr Shutdown		2109-1	200	0.0	0.0	11.2	0.0	74	0.8	E

TABLE E-4

ANALYSIS DATE: OCTOBER 1988

PACKAGED ECO SUMMARY

ECO No.	ECO Name	No. of Boilers	Million Btu's per Year	Savings	*Annual Construc-	Simple Payback	Savings-to-Investment Years
			Electric	Natural Gas	Dollar Cost (\$000)**	Oil Savings (\$000)**	
6	Smaller Boiler	13	0	5,398.8	6,848.8	0.0	80,701
18	New Boiler	29	0	6,542.7	11,755.1	17,743.9	1,427.2
17	New Burner	1	0	0.0	341.8	0.0	2,358
<b>Total Package No. 1:</b>	<b>43</b>	<b>0</b>		<b>11,941.5</b>	<b>18,945.7</b>	<b>17,743.9</b>	<b>318,447</b>
<b>Total Package No. 1:</b>	<b>43</b>	<b>0</b>		<b>11,941.5</b>	<b>18,945.7</b>	<b>17,743.9</b>	<b>318,447</b>

## Package No. 1 - ECIP - Main Permanent

6	Smaller Boiler	13	0	5,398.8	6,848.8	0.0	80,701	420.1	5.2	3.4
18	New Boiler	29	0	6,542.7	11,755.1	17,743.9	235,389	1,427.2	6.1	2.7
17	New Burner	1	0	0.0	341.8	0.0	2,358	10.6	4.5	3.2
<b>Total Package No. 1:</b>	<b>43</b>	<b>0</b>		<b>11,941.5</b>	<b>18,945.7</b>	<b>17,743.9</b>	<b>318,447</b>	<b>1,857.9</b>	<b>5.8</b>	<b>2.8</b>

## Package No. 2 - ECIP - Main Temporary

6	Smaller Boiler	22	0	-3,146.5	6,263.3	0.0	31,246	185.3	5.9	2.5
18	New Boiler	5	0	0.0	1,638.0	0.0	12,482	112.9	8.8	1.8
17	New Burner	1	0	0.0	471.4	0.0	3,216	10.5	3.3	4.4
<b>Total Package No. 2:</b>	<b>28</b>	<b>0</b>		<b>-3,146.5</b>	<b>8,372.7</b>	<b>0.0</b>	<b>46,943</b>	<b>308.7</b>	<b>6.6</b>	<b>2.3</b>

## Package 3 - ECIP - North Fort

6	Smaller Boiler	93	0	-21,928.6	34,281.8	0.0	132,814	816.4	6.1	2.4
<b>Total Package No. 3:</b>	<b>93</b>	<b>0</b>		<b>-21,928.6</b>	<b>34,281.8</b>	<b>0.0</b>	<b>132,814</b>	<b>816.4</b>	<b>6.1</b>	<b>2.4</b>

## Package 4 - OSD-PIF - All Areas

4	Refurbish	117	0	606.1	3,637.1	0.0	38,763	41.3	1.1	7.2
13	Flue Damper	40	0	401.6	3,436.3	0.0	17,176	34.3	2.0	7.9
<b>Total Package No. 4:</b>	<b>126</b>	<b>0</b>		<b>1,007.7</b>	<b>7,073.4</b>	<b>0.0</b>	<b>55,938</b>	<b>75.6</b>	<b>1.4</b>	<b>7.8</b>
<b>TOTAL ALL PACKAGES</b>	<b>290</b>	<b>0</b>		<b>-12,125.9</b>	<b>68,673.6</b>	<b>17,743.9</b>	<b>554,142</b>	<b>3,058.6</b>	<b>5.5</b>	<b>2.9</b>
*	Columns May not Total Due to Rounding	==	==	==	==	==	==	==	==	==

\* Columns May not Total Due to Rounding  
\*\* Construction Cost Does Not Include Design, S10H, or Salvage Value

TABLE E-3

ANALYSIS DATE: OCTOBER 1988

PRIORITYIZED ECO SUMMARY										
ECO No.	ECO Name	Building-Boiler Number	Survey No.	Million Btu's per Year	Savings	Annual Dollar Savings	Construction Cost (\$000)	Payback years	Savings-to-Investment Ratio	Maintenance Code
20.	Turbulators	2019A-1	183	0.0	0.0	90.4	0.0	425	2.0	E
20.	Turbulators	2019B-2	183	0.0	0.0	90.4	0.0	425	2.0	E
20.	Turbulators	1227-1	167	0.0	0.0	62.2	0.0	239	1.3	E
20.	Turbulators	4290-1	226	0.0	0.0	97.1	0.0	454	2.4	E
20.	Turbulators	4290-2	226	0.0	0.0	97.1	0.0	454	2.4	E
20.	Turbulators	IJ8-1	48	0.0	0.0	99.1	0.0	467	2.4	E
20.	Turbulators	1450-2	171	0.0	0.0	181.5	0.0	1013	5.0	E
10.	Total Hit Rcvy	2054-1	197	0.0	0.0	50.7	0.0	147	2.3	E
10.	Total Hit Rcvy	2166-1	206	0.0	0.0	63.1	0.0	229	3.1	E
7.	Time Control	2015B-1	182	0.0	0.0	15.4	0.0	102	0.8	E
7.	Time Control	2019A-1	183	0.0	0.0	15.4	0.0	102	0.8	E
7.	Time Control	2019B-2	183	0.0	0.0	15.4	0.0	102	0.8	E
7.	Time Control	2021A-1	188	0.0	0.0	15.4	0.0	102	0.8	E
7.	Time Control	2021C-1	190	0.0	0.0	15.4	0.0	102	0.8	E
7.	Time Control	2021D-1	191	0.0	0.0	15.4	0.0	102	0.8	E
10.	Total Hit Rcvy	3292-2	277	0.0	0.0	387.2	0.0	2231	12.0	E
7.	Time Control	1020-1	160	0.0	0.0	15.4	0.0	91	0.8	E
20.	Turbulators	2109-1	200	0.0	0.0	43.3	0.0	129	0.9	E
10.	Total Hit Rcvy	1263-1	168	0.0	0.0	72.2	0.0	289	5.0	E
20.	Turbulators	9500-1	261	0.0	0.0	216.0	0.0	1241	8.5	E
20.	Turbulators	14A51-1	281	0.0	0.0	109.1	0.0	533	3.7	E
7.	Time Control	2109-1	200	0.0	0.0	11.2	0.0	74	0.8	E

TABLE E-4

FT. LEWIS EEAP  
FT. LEWIS, WASHINGTON

ANALYSIS DATE: OCTOBER 1988

ANALYSIS DATE: OCTOBER 1988										PACKAGED ECO SUMMARY		
ECO No.	ECO Name	No. of Boilers	Electric	Natural Gas	No. 2 Oil	No. 6 Oil	*Annual Dollar Savings (\$000)	Construction Cost (\$000)	Simple Payback Years	Savings-to-Investment Ratio		
<b>Package No. 1 - ECIP - Main Permanent</b>												
6	Smaller Boiler	8	0	10,885.7	5,215.4	0.0	101,479	517.5	5.1	3.4		
18	New Boiler	9	0	5,835.1	3,422.3	17,743.9	171,390	861.5	5.0	3.2		
17	New Burner	10	0	180.9	2,237.3	936.8	22,901	194.4	8.5	1.7		
<b>Total Package No. 1:</b>		<b>27</b>	<b>0</b>	<b>16,901.7</b>	<b>10,875.0</b>	<b>18,680.7</b>	<b>295,770</b>	<b>1,573.4</b>	<b>5.3</b>	<b>3.1</b>		
<b>Package No. 2 - ECIP - Main Temporary</b>												
6	Smaller Boiler	22	0	-3,146.5	6,263.3	0.0	31,246	206.7	6.6	2.3		
18	New Boiler	2	0	.0.0	193.2	0.0	2,035	10.6	5.2	2.8		
17	New Burner	2	0	0.0	877.9	0.0	6,033	24.3	4.0	3.6		
<b>Total Package No. 2:</b>		<b>26</b>	<b>0</b>	<b>-3,146.5</b>	<b>7,334.4</b>	<b>0.0</b>	<b>39,314</b>	<b>241.6</b>	<b>6.1</b>	<b>2.5</b>		
<b>Package 3 - ECIP - North Fort</b>												
6	Smaller Boiler	27	0	-3,609.4	7,601.4	0.0	39,268	190.8	4.9	3.1		
17	New Burner	1	0	0.0	226.7	0.0	1,627	12.1	7.4	1.9		
<b>Total Package No. 3:</b>		<b>28</b>	<b>0</b>	<b>-3,609.4</b>	<b>7,828.1</b>	<b>0.0</b>	<b>40,895</b>	<b>202.9</b>	<b>5.0</b>	<b>3.0</b>		
<b>Package 4 - OSD-PIF - All Areas</b>												
4	Refurbish	201	0	805.6	6,846.3	0.0	69,162	68.6	0.9	7.7		
13	Flue Damper	44	0	401.6	3,863.0	0.0	19,244	37.5	1.9	8.1		
<b>Total Package No. 4:</b>		<b>201</b>	<b>0</b>	<b>1,207.2</b>	<b>10,709.3</b>	<b>0.0</b>	<b>88,407</b>	<b>106.1</b>	<b>1.2</b>	<b>8.6</b>		
<b>TOTAL ALL PACKAGES</b>		<b>282</b>	<b>0</b>	<b>11,353.0</b>	<b>36,746.8</b>	<b>18,680.7</b>	<b>464,386</b>	<b>2124.0</b>	<b>4.6</b>	<b>3.4</b>		

\* Columns May not Total Due to Rounding

NARRATIVE REPORT - SEPARATELY BOUND

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